ANNUAL REPORT FY 73
RESERVOIR CONTROL CENTER

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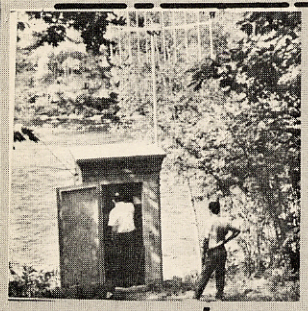

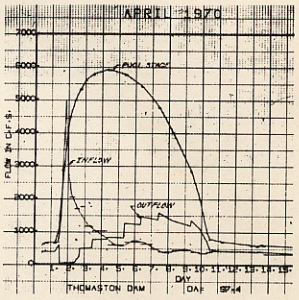

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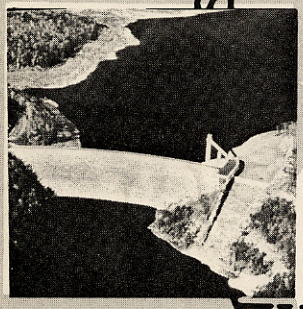

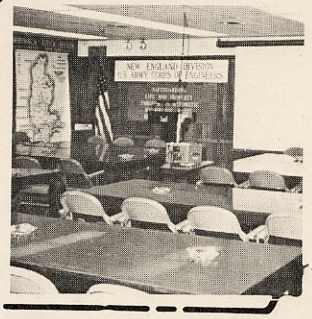

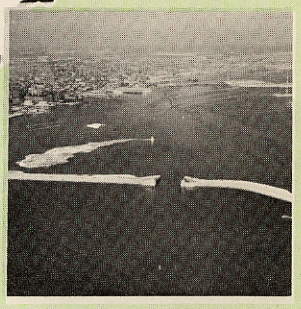

MASS.

CONN.

R.I.

U.S. ARMY ENGINEER DIVISION
NEW ENGLAND

WALTHAM, MASS.

NOVEMBER 1973

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASSACHUSETTS

RESERVOIR CONTROL CENTER

ANNUAL REPORT

FISCAL YEAR 1973

NOVEMBER 1973

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A. SCOPE OF REPORT

This publication has been prepared to review the activities of the Reservoir Control Center in FY 1973. It contains information on the operation of the reservoirs and hurricane barriers within the New England Division, and also includes the status and results of special reservoir studies or investigations that have been performed or are in the planning stage.

B. REFERENCES

The report was prepared in accordance with ER 1110-2-1400, subject: "Reservoir Control Centers," dated 24 April 1970, ER 1110-2-240, "Reservoir Regulation," dated 22 April 1970 and OCE 1st Indorsement to NED, dated 1 October 1968, subject: "Establishment of Reservoir Control Center." Since this report is an annual supplement to the Reservoir Control Center Guidance Memorandum, dated September 1971, duplication of information, charts, maps, etc. contained in the memorandum has been kept to a minimum.

C. ORGANIZATION AND PURPOSE

Responsibility for supervision of the Center is under Chief, Water Control Branch who reports to the Chief, Engineering Division, New England Division. The Reservoir Control Center is one of four sections of this branch. The other three include Hydrologic Engineering, Hydraulics and Water Quality.

The Reservoir Control Center (RCC) was approved by the Chief of Engineers in October 1968. Its basic purpose is to enhance the capabilities of the Corps of Engineers to perform its civil works mission as related to the operation of reservoirs. As projects increase in number and complexity, and as demands for services multiply, the need for emphasis on effective management continues to grow. This is particularly true since national attention is being focused on the impact of projects on environmental conditions, water quality control and recreation.

The responsibilities of RCC encompass reservoir management, coordination, data collection and special studies. Specific responsibilities include the following:

1. Direct the regulation of reservoirs and hurricane barriers within NED.

2. Collect, analyze and interpret current hydrologic and meteorologic data for regulation purposes.

3. Prepare and update regulation plans and manuals for reservoirs, hurricane barriers and local protection projects.

4. Coordinate with Corps, Federal, State or local personnel involved directly or indirectly with regulation plans and procedures.

The other three sections of the Water Control Branch provide technical assistance and manpower as needed in reservoir management activities during flood alerts or for special studies. The organizational structure of the branch and major duties of each section are summarized in plate 1.

D. GENERAL BACKGROUND

This is the second annual report for the Center and a brief description of the water resources developments completed by the Corps, exclusive of navigation improvements, is included for information. Within the New England Division, the Corps has completed 35 dams, 37 local protective works and 4 hurricane barriers. Thirty-one of the 35 reservoir projects and two of the four hurricane barriers are operated and maintained by the Corps, with the remaining projects, including local protection, operated and maintained by local interests.

Although most of the projects constructed prior to 1955 were authorized for flood control purposes only, other uses have been approved at many of these reservoirs as the water resource needs in the basins have increased. Most of the newer projects have been built for multipurpose uses such as flood control, water supply, low flow augmentation and recreation. None of the 35 reservoirs are operated for irrigation, navigation or hydroelectric power purposes.

The primary function of each reservoir is to provide flood control protection to downstream communities located on tributaries or, as a system to prevent or reduce flood damages at downstream

ORGANIZATION AND FUNCTIONS CHART

ORGANIZATION

ENGINEERING DIVISION

WATER CONTROL BRANCH

Cooper, S.* Supv. Hyd. Eng.
Cotter, M. Secretary
Graham, B. Stenographer

Reservoir Control Center		Hydrologic Engineering Section		Hydraulics Section		Water Quality Section	
Finegan, J.*	Hyd. Eng.	Manley, P.*	Hyd. Eng.	Reid, L *	Hyd. Eng.	DiBuono, R.*	Hyd. Eng.
Mirick, R.	Hyd. Eng.	Donati, O.	Hyd. Eng.	Merli, K	Hyd. Eng	Buelow, D.	Hyd. Eng.
Doherty, R.	Hyd Eng.	Michielutti, R.	Hyd. Eng.				
Feeney, T.	Hyd. Eng.	Brudnick, W.	Hyd. Eng.				
Horowitz, J.	Hydrologist	Parker, S.	Hyd. Eng.				
Hetu, P.	Eng Tech.	Burns, P	Eng. Tech.				
Simons, H	Capt. U.S. Army						
Lambie, F.	Part Time						

FUNCTION ASSIGNMENTS

Reservoir Management
Reservoir Regulation
Reservoir Manuals
Hydrologic Equipment
Coordination

Data Collection
Coord. w/USGS, NWS
Auto. Hydrol. System
NASA - ERTS & Skylab Exp.
Data Analysis

Special Studies
River Forecasting Techniques
Low Flow Studies
Special Res. Studies

Planning
NEWS
SENE
Survey Reports
Urban Studies

Design
Reservoirs
Local Protection Projects
Hurricane Barriers

Small Projects
205 Projects
Flood Plain Information
Flood Insurance

Hydraulic Design For
Reservoirs
Local Protection Projects
Hurricane Barriers

Coordination
Analysis
Wastewater Studies
Planning
Design
Data Collection

* Chief

Current Table of Organization
July 1973

PLATE 1

communities along the major rivers. Other authorized reservoir uses such as water supply, low flow augmentation and recreation are limited in scope.

E. ACCOMPLISHMENTS OF RCC DURING FY 1973

1. Regulation Manuals

a. The revised regulation manual for Appendix D, West River Watershed of the Master Manual for the Connecticut River Basin is 95 percent complete.

b. The revised regulation manual for Appendix F, Millers River Watershed of the Master Manual for the Connecticut River is 90 percent complete.

c. Continued work on a revised Master Manual for the Merrimack River Basin.

d. Initiated work on a revised Master Manual for the Housatonic River Basin.

e. Completed the Flood Operating Procedures for the Derby, Connecticut Local Protection Project.

2. Reports

a. In association with the on-going 216 Studies at NED, the Franklin Falls and MacDowell Reservoirs were studied to determine both the adequacy of hydrologic design criteria and regulation procedures.

b. Prepared an Interim Report entitled: "Tidal Hydrology, Long Island Sound" for the New England River Basins Commission.

3. Data Collection. The NED Automatic Hydrologic Radio Reporting System has been in existence about four years and has become a most important tool for providing accurate and timely data necessary for regulation of the NED flood control works. The Reservoir Control Center's IBM 1130 computer, coupled with a Data General mini-computer, has the capability of interrogating all 41 remote reporting stations at specified times, performing analyses on the data and plotting and storing the results.

During FY 1973, NED began experimenting with data relay by satellite, using the Data Collection System (DCS) of the Earth Resources Technology Satellite (ERTS) which was launched in July 1972. The study involves a network of 27 data collection platforms located throughout New England. The system relays hydrometeorological information such as river stage, rainfall, wind, tide and water quality parameters to RCC in near real time. A report, scheduled for completion in August 1974, will outline our findings on both the operational reliability as well as the cost of establishing and maintaining a satellite relayed data collection network for use by the Corps on a nationwide basis as compared to existing ground-based radio relay methods. Preliminary analyses to date indicate a high degree of reliability of the data information with a minimum amount of equipment maintenance necessary. Data received has been used for operational and emergency planning purposes, especially during the spring floods in Maine and again in late June when significant floods occurred in New Hampshire and Vermont.

In addition, RCC is evaluating the ability of ERTS imagery to provide useful and timely supplementary hydrologic information either for planning or operational purposes. This portion of the ERTS experiment is subcontracted to the University of Connecticut at Storrs. The work has been centered on both photo-interpretation and computer-oriented analyses of the imagery.

During the spring of 1973, in cooperation with the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, New Hampshire, RCC began participating in the Skylab manned satellite studies. The potential usefulness of the resolution and types of imagery being experimented with by the Skylab astronauts for future RCC short range operational and longer range planning purposes are being assessed.

In FY 1973 the U.S. Geological Survey, the Massachusetts Division of Water Pollution Control and the Corps began a 3-year cooperative demonstration project of computer linked water quality monitors. A total of four stations have presently been installed. The information is received at the Reservoir Control Center through a dedicated telegraph line and is providing data for a pilot study in which the Commonwealth of Massachusetts is investigating the feasibility of collecting and using "real time" water quality data. This information is being stored for analyses and will be automatically

transmitted to the State by a telephone data set. Also in FY 1973 RCC continued to explore the establishment of a computer data link for exchange of real time hydrometeorological information with the Hartford River Forecast Center in Connecticut. It is anticipated that a data link will be established in FY 1974.

4. RCC Meetings with Others Concerning Regulation Activities

1972
July

Met with University of Connecticut personnel concerning the ERTS-1 satellite experiment and imagery interpretation.

Met with staff members of the U.S. Army Cold Regions Research and Engineering Laboratory to discuss cooperative efforts between RCC and CRREL.

August

Discussed the possibility of using radio-isotopes for power supply in our remote sensing stations with OCE (power research) personnel.

Installed ERTS platform at Hartford, Connecticut which was filmed by Channel 3 News of Hartford.

September

None

October

Visited University of Connecticut with CRREL staff members concerning cooperation in ERTS-1 research program.

Met with personnel from Naval Underwater Systems, Newport, Rhode Island to discuss possible technology transfers.

Met with personnel from Wilmington District of the Corps to discuss our Automatic Hydrologic Radio Reporting System.

Met with students from Harvard School of Forestry to brief them on RCC procedures.

November and December

None

1973
January

Visited the American Optical Company in Southbridge, Massachusetts to discuss the new flood control gate that they will install at their dam on the Quinnebaug River.

Met with Mr. Eichert of the Hydrologic Engineering Center to discuss Merrimack River flood forecasting procedures.

February

Visited Ansonia Local Protection Project and met with representatives of the Penn Central Transportation Company to discuss the proposed Flood Operating Procedures.

Met with engineers of the International Telephone & Telegraph Company in order to familiarize them with the Hydrologic Reporting System.

March

Visited Ansonia, Connecticut and met with the Commissioner of Public Works to discuss operation of the local protection project during flood periods.

Visited Peterborough, New Hampshire and met with the Peterborough Industrial Commission regarding minimum floor elevation at the Brookside Apartments to be located along Nubanusit Brook about one-half mile downstream of MacDowell Dam.

Traveled to East Granby, Connecticut to speak on Colebrook reservoir regulation procedures to the Farmington River Watershed Association.

Attended ERTS Symposium in College Park, Maryland. More than 300 papers were presented by investigators on results of their experiments.

March (cont.)

Visited Edward MacDowell Dam with New Hampshire Fish and Game personnel to discuss possible reservoir sub-impoundment.

Described the Corps flood control program in New England at a regional meeting of the Factory Mutual Insurance Company in Norwood, Massachusetts.

April

Presented a talk on the Hydrologic Interrogation System at a Boston Society of Civil Engineers meeting.

Attended OCE Water Control Management Conference in Washington, D. C.

Discussed Worcester Diversion Project with Town Selectmen in Auburn, Massachusetts.

Visited CRREL to review progress of the ERTS experiment.

Spoke to the ASCE Student Chapter, Merrimack College in North Andover, Massachusetts on the responsibilities of the Reservoir Control Center.

May

Traveled to Bristol, New Hampshire and visited the Ayers Island Dam owned by the N. H. Public Service Company. This dam is located at the upstream end of Franklin Falls Dam and the project was inspected in connection with on-going "216 Studies".

Met with Mr. Peters of the Hydrologic Engineering Center to discuss Merrimack River flood forecasting procedures.

Met with HEC personnel in California to review and discuss progress on the Merrimack River flood study.

Participated in ERTS-1 Data Collection Workshop at NASA's Wallops Station, Virginia. This form was the first major

May (cont.)

gathering of all groups working with satellite relay of earth resources data.

June

Visited Athol, Massachusetts High School to discuss reservoir regulation procedures.

5. Training of Personnel

a. Field Personnel. During FY 1973 RCC personnel visited the following projects on one or more occasions to discuss regulation procedures with the project managers and assistants and to observe downstream control points during periods of high waters:

Connecticut River	Merrimack River
North Springfield	Edward MacDowell
Tully	Franklin Falls
	Hopkinton-Everett
Blackstone	
	Thames River
West Hill	
	Westville
Housatonic River	Hodges Village
	Buffumville
Thomaston	
Black Rock	Hurricane Barriers
Hop Brook	
	New Bedford, Mass.
	Stamford, Conn.
	Fox Point (Providence, R. I.)

b. Mini-Conferences. During FY 1973 NED sponsored three mini-conferences at various reservoirs throughout New England, attended by the project managers and assistants in the selected river basins. RCC personnel discussed the regulation procedures and reasons for establishing them.

c. RCC Personnel. In addition to "on-the-job" training, the services of the Hydrologic Engineering Center in California

and the Civil Service Commission were used as follows during the year:

HEC Courses

Hydrologic Probabilities

CSC Courses

Middle Management Institute
Technical Writing and Editing
Effective Oral Presentation

6. Summary of Weather Conditions Affecting Regulation

a. July, August, September 1972. Temperatures averaged near normal during this period but precipitation was quite variable. During July, precipitation was above normal at most stations but most unusual was the frequency of thunderstorms. Precipitation during August was normal and during September was extremely variable with less than 1 inch in northwestern New England and up to 12-16 inches on Cape Cod and the Islands. The rain from storm "Carrie" on 3 September and the coastal storm of the 19th caused local flooding and beach erosion along Cape Cod.

b. October. This month was very cold with temperatures averaging 4 to 6 degrees below normal. Precipitation was normal with only one significant storm. On 7 October an intense coastal storm accompanied by heavy rain moved through southern and eastern New England. Rainfall in the three southern States generally averaged 2-3 inches with lesser amounts in northern areas. Some minor flooding occurred.

c. November. This month was very cold, wet and snowy in many areas of New England. Coastal storms occurred on the 9th, 14th, 19th and 27th producing heavy precipitation of rain and/or snow and high winds. Considerable damage occurred from washouts, local flooding and heavy, wet snow.

d. December 1972 and January 1973. Both temperature and precipitation were normal and there were no significant storm periods.

e. February. Two significant storms occurred in February. An intense storm center moving through the Great Lakes region dropped rainfall amounts of 2 to 3 inches on southern New England and 1 to 2 inches on northern areas during the afternoon and evening of 2 February. Although no significant flood damage occurred, many rivers in Massachusetts, Connecticut and Rhode Island approached flood stage. Reservoirs in the Naugatuck, Thames, Blackstone and lower Connecticut River basins were operated to reduce flows in the rivers. On the morning of the 15th, a fast moving coastal storm dropped 1 to 1-1/2 inches of rain over most of southern New England and 6 to 10 inches of snow over the northern areas. There was no flooding associated with this storm and the dams were not operated.

f. March. Precipitation was near normal with only one significant storm, and temperatures averaged well above normal with unusually mild weather. On 17 March a very large and intense late winter storm passed to the west of New England bringing warm air and 1 to 2 inches of rain. Snowmelt was already active and the additional rainfall caused the Connecticut and Merrimack Rivers to rise to bankfull capacity.

g. April. A warm and wet first week of April brought a potential flood threat to New England. A complex storm system moving into the area on the 1st and 2nd of April brought heavy rain to all of New England. Small stream flooding occurred due to a 1-2 inch rainfall in southern New England and a 2-3 inch rainfall in northern New England.

On the afternoon and evening of 4 April an intense and rapidly moving coastal storm passed through southern New England. Rainfall was heaviest along the coastal areas and snowfall occurred in New Hampshire and Vermont. Rainfall was less than expected and due to an influx of cold air and a changeover to snow in most areas, no flood problem occurred.

h. May. Temperatures averaged about normal, precipitation was slightly above normal and there were no significant storm periods.

i. June. Temperatures were about normal and precipitation was slightly above normal during most of June. During the period 27-30 June, a stationary frontal system in association with a strong southerly tropical airflow caused moderate to heavy shower activity

over most of the New England area. Rainfall amounts varied from 2 inches in coastal regions to approximately 8-10 inches in the mountainous areas of Vermont and New Hampshire. This storm caused major flooding in the northern areas of the Merrimack and Connecticut River basins.

7. Regulation of Reservoirs

a. General. All 35 dams have flood control as a primary function and most of the regulation at NED is for flood control purposes. Other reservoir uses, although limited in scope, include water supply, low flow augmentation and recreation. In addition, small winter pools are maintained at many reservoirs to keep the gates from freezing.

There is no flood-free season of the year in New England. During the spring snowmelt season, which usually occurs in March or April in the southern areas and April or May in the northern reaches, several weeks of regulation within a watershed is a nearly annual occurrence. Hurricanes pose a potential problem each year during the late summer and autumn months. Extratropical coastal storms generally forming near the Middle Atlantic States travel northward and occur frequently during the autumn, winter and spring months.

b. Flood Control

(1) On 7 October 1972, a coastal storm brought heavy rainfall with 2-3 inches in southern and central New England. Runoff was not significant however and flooding was not a problem because of dry antecedent conditions.

(2) During the night of 8-9 November a severe coastal storm accompanied by gale force winds and heavy rains dropped 2-4 inches in the three southern States with lesser amounts in northern areas. Storage of floodwaters was only minimal and no flooding developed.

(3) On 14 November another storm accompanied by gale winds, moderate rain increased river levels in all southern basins

(4) The third coastal storm in less than two weeks

struck the New England area with gale winds and up to 1-1/2 inches of rain on 19 November. Although most rivers experienced higher than normal stages, no flooding occurred and throttling of reservoir releases was not necessary.

(5) On 27 November the entire area was again hit with a fast moving storm system, accompanied by gale winds and 1 to 2 inches of rain. River levels increased significantly but crested below flood stage. Reservoirs in the Naugatuck and Westfield River watersheds were operated and utilized storage from 4 to 8 percent.

(6) During the third week of December, high spring monthly tides, in association with several small wave disturbances moving through southern New England resulted in an unusual number of hurricane barrier operations, namely, seven at Stamford and three at Fairhaven-New Bedford. River flooding was not a problem during this period.

(7) On 2 February a complex storm system moving through the Great Lakes region dropped rainfall amounts of 2 to 3 inches on southern New England and 1 to 2 inches in northern areas. This heavy rain in association with warm southerly winds (50° - 60°) resulted in active snowmelt and considerable runoff in Connecticut, Massachusetts and Rhode Island. All reservoirs in these States were operated. River levels approached or reached flood stage in all southern basins. Appreciable reservoir flood control storage was utilized during this event with amounts varying from 20-25 percent in Connecticut, 10-20 percent in Massachusetts and up to 10 percent in New Hampshire.

(8) On 17 March a large, late winter storm passed to the west of New England bringing an influx of 50° - 60° temperatures and widespread moderate to heavy shower activity to the entire region. Rainfall averaged 1-2 inches with heaviest amounts in the northern and western mountainous areas. Stages in the Connecticut and Merrimack Rivers rose to bankfull capacity. All reservoirs in the two basins stored floodwaters with amounts averaging 20-25 percent in Vermont, 10-20 percent in New Hampshire and 15 percent in Massachusetts.

(9) Another complex system moved into the area on 1-2 April and brought heavy rains to all New England with highest amounts along eastern coastal sections. The Merrimack River

crested at 2-3 feet below flood stage and minimal amounts of storage were utilized at all five reservoirs in the watershed.

(10) A fast moving storm passed through southern New England on 4 April. Due to the existence of high stages in the lower reaches of the Connecticut and Merrimack Rivers, a potential flood threat existed. However, rainfall was less than 1 inch and no flood problems resulted.

(11) During the last days of June 1973, moderate to heavy shower activity over widespread areas of New England occurred. Rainfall amounts varied from about 2 inches in coastal regions to approximately 7 inches in the hills of western Connecticut to 8-10 inches in the mountainous regions of Vermont and New Hampshire. An isohyetal map of the rainfall is shown on plate 2. At times on the 29th and 30th the shower activity was torrential in nature with reported amounts of 4 inches in 6 hours.

This storm caused the largest recorded summer flood (June, July, August) in many watersheds of Vermont and New Hampshire that drain the Green and White Mountains. In several of these watersheds such as the Ottauquechee, Black and Ammonoosuc Rivers the peak discharges approximated the devastating floods of November 1927 or March 1936.

The Naugatuck River watershed experienced heavy rainfall and flooding occurred on several small unprotected streams. There were no problems in the Thames and Blackstone River basins.

All reservoirs in the Connecticut, Merrimack and Naugatuck River basins were operated. In the Connecticut basin the five Vermont reservoirs bore the brunt of this flood and stored near record amounts averaging 50 percent. Lesser amounts of 10 to 20 percent were used in the remaining projects. In the Merrimack basin, Franklin Falls stored to 66 percent with other reservoirs averaging 10-20 percent. The Naugatuck reservoirs stored from 10 to 28 percent of capacity.

A tabulation of the maximum reservoir stages at Corps projects for FY 1973 and for the period of record are listed on plate 3. A fiscal year record of reservoir data for the Corps manned (gate operated) dams, including water levels, outflows and precipitation, is shown on plates 5 through 32.

RAINFALL PATTERN
27 – 30 JUNE 1973

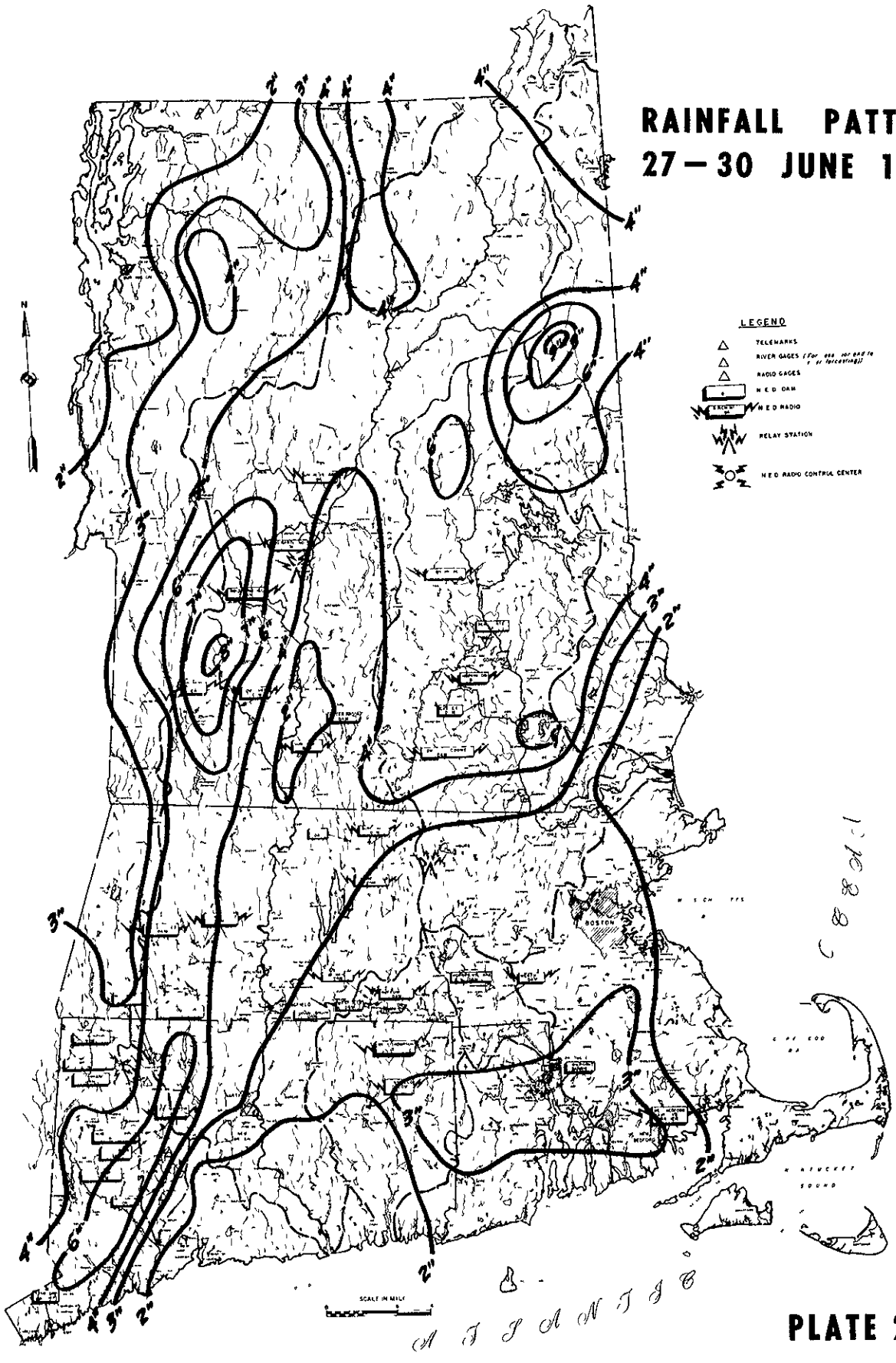


PLATE 2

MAXIMUM RESERVOIR IMPOUNDMENTS

Reservoir	FY 1973 Stage (ft)	FY 1973 % Full	FY 1973 Date	Period of Record Stage (ft)	Period of Record % Full	Period of Record Date	Placed in Operation
Union Village	79	18	Jun 73	114.2	53	Apr 69	1950
North Hartland	95	35	Jun 73	128.2	63	Apr 69	1961
North Springfield	58	36	Jun 73	78.8	69	Apr 69	1960
Ball Mountain	170	51	Jun 73	197.8	82	Apr 69	1961
Townshend	58	30	Jun 73	80.3	65	Apr 69	1961
Surry Mountain	31.3	20	Mar 73	58	79	Mar 48	1941
Otter Brook	39.5	13	Mar 73	82.6	71	Apr 69	1958
Birch Hill	12.3	9	Feb 73	25	40	Apr 60	1941
Tully	20.0	11	Feb 73	32.3	51	Apr 60	1949
Barre Falls*	782.1	9	Feb 73	798	55	Apr 60	1958
Conant Brook**	16.6	6	Feb 73	18	7	Feb 70	1966
Knightville	67.5	18	Mar 73	130	100	Jan 49	1941
Littleville*	531.4	18	Mar 73	540.7	33	Apr 69	1965
Colebrook River*	739.8	53	Jul 72	739.8	53	Jul 72	1969
Mad River**	47.5	7	Feb 73	50.3	9	Apr 69	1963
Sucker Brook**	18	13	Feb 73	22	18	Aug 69	1970
Franklin Falls*	334.9	18	Jun 73	376	76	Mar 53	1943
MacDowell*	922.9	24	Mar 73	936	58	Jan 56	1950
Hopkinton*	396.4	13	Apr 73	405	44	Apr 69	1962
Everett*	358.4		Apr 73	397.1			1961
Blackwater*	543.0	10	Apr 73	561.6	72	Apr 69	1941
Hodges Village	13.1	11	Feb 73	23.4	44	Mar 68	1959
Buffumville	17.8	14	Feb 73	28.4	43	Mar 68	1958
East Brimfield	19.0	14	Feb 73	23.8	35	Mar 68	1960
Westville	40.9	22	Feb 73	49	51	Mar 68	1962
West Thompson	27.1	20	Feb 73	37.5	47	Mar 68	1965
Mansfield Hollow	30.3	17	Feb 73	52	67	Aug 55	1952
West Hill	12.4	14	Feb 73	24.3	59	Mar 68	1961
East Branch**	27.4	14	Feb 73	27.4	14	Feb 73	1964
Hall Meadow**	14.5	10	Feb 73	15	10	Mar 68	1962
Thomaston	60.0	19	Feb 73	60.0	19	Apr 69	1960
Northfield Brook**	45.2	15	Feb 73	45.2	15	Feb 73	1965
Black Rock	65.6	25	Feb 73	65.6	25	Feb 73	1970
Hancock Brook**	11.8	11	Feb 73	13.8	17	Feb 70	1966
Hop Brook	47.0	28	Jun 73	47.0	28	Jun 73	1968

* Elevation of pool in feet msl

** Ungated project

NOTE: The heavy rains in New England during the last days of June 1973 resulted in the storage of floodwaters at all reservoirs in the Connecticut, Merrimack and Housatonic River basins. In July 1973 near record reservoir flood levels occurred at Franklin Falls (66%), Union Village (33%), North Hartland (50%), North Springfield (66%), Ball Mountain (59%) and Townshend (41%).

PLATE 3

c. Benefits Associated with Regulation of Reservoirs and Local Protection Projects. A summary of the estimated damages prevented by the reservoirs and local protection projects during FY 1973 follows:

	Damages Prevented		
Basin	Reservoirs	Local Protection Projects	Total
Connecticut	$ 53,000	$4,947,000	$5,000,000
Merrimack	45,000	-	45,000
Thames	1,126,000	-	1,126,000
Housatonic	-	-	-
Blackstone	-	40,000	40,000
Coastal	-	-	-
	$1,224,000	$4,987,000	$6,211,000

NOTE: These figures do not include benefits associated with the flood of June-July 1973. These benefits, to be carried in the FY 1974 report, include $27 million in the Connecticut River basin and $3 million in the Merrimack River basin.

d. Other Regulation Activities

(1) Ball Mountain Lake. This project was regulated in October 1972 and May 1973 for white water canoeing. The 60-foot deep summer pool is lowered approximately 30 feet every October. Drawdown was initiated at the beginning of the Columbus Day weekend to provide a flow of 1,200 cfs on the 14th and 15th of October. This event attracted 125 participants and about 1,500 spectators. In May, following the snowmelt period, the pool stage was built up to approximately 75 feet to insure that enough water was available to maintain an average release of 2,000 cfs on the 12th and 13th for the Eastern Regional Canoe and Kayak Slalom Championships. These National Trials drew more than 100 participants and hundreds of spectators.

(2) Knightville Dam. The annual Westfield River Canoe Race was held on 1 April. A controlled release rate of 1,100 cfs was maintained for the race, which attracted more than 250 contestants and several thousand spectators.

(3) Colebrook River Lake. Releases were made from the fall fishery pool during the latter part of July and most of August in order to maintain a minimum flow in the Farmington River at Riverton, Connecticut. The temporary spring fishery pool was drawn down during the last two weeks of June 1973.

(4) West Thompson Lake. After the Labor Day weekend, the 13-foot deep pool was slowly raised to 15 feet to provide satisfactory water levels for the Shoreline Retriever Club of Connecticut. The club ran a major 3-day AKC retriever trial for more than 100 dogs on 15-17 September.

(5) East Brimfield. The American Optical Company of Southbridge owns 1,140 acre-feet of storage between the stages of 9 and 13 feet. However, there was no request during the year to augment downstream flows by releasing from their storage.

8. Regulation of Hurricane Barriers. The New Bedford-Fairhaven barrier was operated on 12 occasions with estimated benefits of $510,000. The Stamford barrier was operated for 24 events with benefits of $450,000. A summary of the most severe storms at each project follows:

STAMFORD BARRIER

	Predicted Tide Elevation	Observed Peak Tide Elevation		Wind Direction	Wind Velocity
		Ocean (ft, msl)	Harbor (ft, msl)		(knots)
19 Nov 72	6.0	7.4	5.2	N	10
21 Dec 72	5.7	7.4	5.7	ENE	10
22 Dec 72	5.4	7.5	5.5	NE	15-20
4 Apr 73	5.7	8.2	4.8	E	20

NEW BEDFORD BARRIER

19 Nov 72	3.7	6.1	4.5	S	35-50
26 Nov 72	2.6	5.1	3.8	SSE	40-50
17 Mar 73	2.9	5.1	3.3	SSE	25-30
4 Apr 73	3.2	5.4	4.0	ESE	10-30

There were no operations at the Fox Point and Pawcatuck barriers which prevented significant damage from tidal flooding.

STATUS AND SCHEDULE
FOR SUBMISSION OF REGULATION MANUALS

NEW ENGLAND DIVISION
(JUNE 1973)

	Status of Manual		Estimated Date	O&M by
	Approved	Submitted	For Completion	Local Interests
Connecticut River Basin				
Master Manual	-	-	Jun 76	
Union Village	X	May 71		
North Hartland	X	May 69		
North Springfield	X	Oct 69		
Ball Mountain	X	Jun 65	Oct 73**	
Townshend	X	Jun 65	Oct 73**	
Surry Mountain	X	Jan 72		
Otter Brook	X	Jan 72		
Birch Hill	X	Jan 50	Oct 73**	
Tully	X	Jan 50	Oct 73**	
Barre Falls	X	Jun 64		
Conant Brook	X	Jun 64		
Knightville	X	Jun 67		
Littleville	X	Jun 67		
Colebrook River	X	Jun 70		
Mad River	X	Jun 70		X
Sucker Brook	X	Jun 70		X
Merrimack River Basin				
Master Manual	X	Jun 53	Jun 74**	
Franklin Falls	X	Jun 53	Jun 74**	
Blackwater	X	Jun 53	Jun 74**	
Edward MacDowell	X	Mar 50	Jun 74**	
Hopkinton-Everett	-	Nov 62*	Jun 74	
Thames River Basin				
Master Manual	X	Jun 67	Jun 75**	
Mansfield Hollow	X	Jun 67	Jun 75	
Buffumville	X	Jun 67	Jun 75	
Hodges Village	X	Jun 67	Jun 75	
East Brimfield	X	Jun 67	Jun 75	
Westville	X	Jun 67	Jun 75	
West Thompson	X	Jun 67	Jun 75	
Blackstone River Basin				
Master Manual	X	Jun 66		
West Hill	X	Jun 66		
Housatonic River Basin				
Master Manual	X	Jun 64	Jun 74**	
Hall Meadow Brook	X	Jun 64		X
East Branch	X	Jun 64		X
Thomaston	X	Jun 64	Jun 74**	
Northfield Brook	X	Jun 64		
Hancock Brook	X	Jun 64		
Hop Brook	-	Jun 70*	Jun 74	
Black Rock	-	Jun 70*	Jun 74	
Hurricane Barriers				
New Bedford-Fairhaven	X	Dec 69		X***
Stamford	X	Apr 69		X***

* Standard Operating Procedure (SOP) prepared at completion of dam
** Revised Manual
*** Navigational gates in project operated by Corps of Engineers

PLATE 4

F. DATA COLLECTION AND COMMUNICATIONS FACILITIES

The Guidance Memorandum contains a thorough discussion of RCC activities in these fields. The programs are reviewed annually in coordination with the respective agencies, in terms of real coverage, reporting criteria and reliability.

G. STATUS OF RESERVOIR REGULATION MANUALS

The current status of reservoir regulation manuals for completed projects is contained in plate 4. RCC recognizes that regulation manuals are vital documents to the water management responsibilities of the Corps, therefore in order to improve the quality content of previously approved manuals, emphasis has been given to revising master manuals for the Thames, Naugatuck and Merrimack River basins during the next two years.

H. FUTURE ACCOMPLISHMENTS AND OBJECTIVES

1. General. In future years RCC will continue to improve reservoir management techniques, to review and update if necessary our data collection systems and develop flood forecasting techniques for regulation purposes based on the real time collection of data.

2. Data Collection. During FY 1974, RCC will continue studies in the ERTS-1 experiment to determine the reliability and economic feasibility of data collection by satellite relay for the purpose of reservoir regulation. A questionnaire will be sent to all Corps offices to help determine Corps-wide needs and costs for automated data collection, and thus provide a framework to place the results of our investigation. This report is scheduled to be submitted to OCE and NASA in August 1974.

Our ERTS-B proposal to NASA is under consideration. The highlight of this possible ERTS-B investigation would be the installation of a direct downlink from the satellite to our computer facility at the Reservoir Control Center for the direct collection of data relayed from the ERTS-1 data collection platforms.

In FY 74 we hope to experiment with several data collection platforms associated with the NOAA satellite known as GOES. This satellite is scheduled for launch in January 1974.

Imagery from the manned Skylab satellite mission, together

with that from supportive aircraft underflights, will be received and analyzed for RCC by the U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire. CRREL will evaluate the resolution and types of imagery in relation to potential uses by RCC.

The cooperative project of computer linked water quality monitors, involving the U.S. Geological Survey, the Massachusetts Division of Water Pollution Control and the Corps of Engineers will continue in FY 1974 with more stations being incorporated into the network. Also, RCC will continue to explore the establishment of a computer data link with the Hartford River Forecast Center.

In FY 74, we plan to continue pursuing the expansion of the core storage of the mini-computer from 16,000 to 32,000 words, and also installing a disk pack capable of storing up to 12 million words in order to handle the increasing amount of real time hydrologic data that will be collected.

3. Reservoir Management. In connection with the on-going Section 216 Studies in which the design criteria of older Corps flood control projects are being reviewed due to changing conditions, RCC will investigate the possible reformulation of reservoir storages.

4. Flood Forecasting. The Hydrologic Engineering Center's study program, which is developing a flood forecasting technique for the Merrimack River basin based on real time hydrologic data, is expected to have a pilot program by February 1974.

I. FUNDING

RCC obtains funds from many sources for its varied activities. The Operation and Maintenance budget, prepared annually, includes funds for the normal operation of the Control Center. These funds include salaries for personnel involved in reservoir control matters, costs for the Hydroclimatic Network and USGS Cooperative Stream Gaging Program, and costs for leasing and amortizing equipment used by the Control Center such as the Automatic Hydrologic Radio Reporting Network, computer and Control Center building. Funds are obtained also from the Plant Replacement Program for the purchase of major equipment such as computers, displays, and hydrologic equipment not associated with a particular project. Regulation studies performed for Survey Reports and Design Memorandums are

charged to the respective study. New regulation manuals are prepared while projects are under construction, and costs are included in the construction of these projects as well as any hydrologic equipment required for the operation such as gaging equipment, radios and water quality monitors. In addition, the Control Center receives funds from OCE for its participation and coordination of projects associated with Section 216 of Public Law 91-611. Funds granted by NASA have formed the basis of support for the ERTS and Skylab programs.

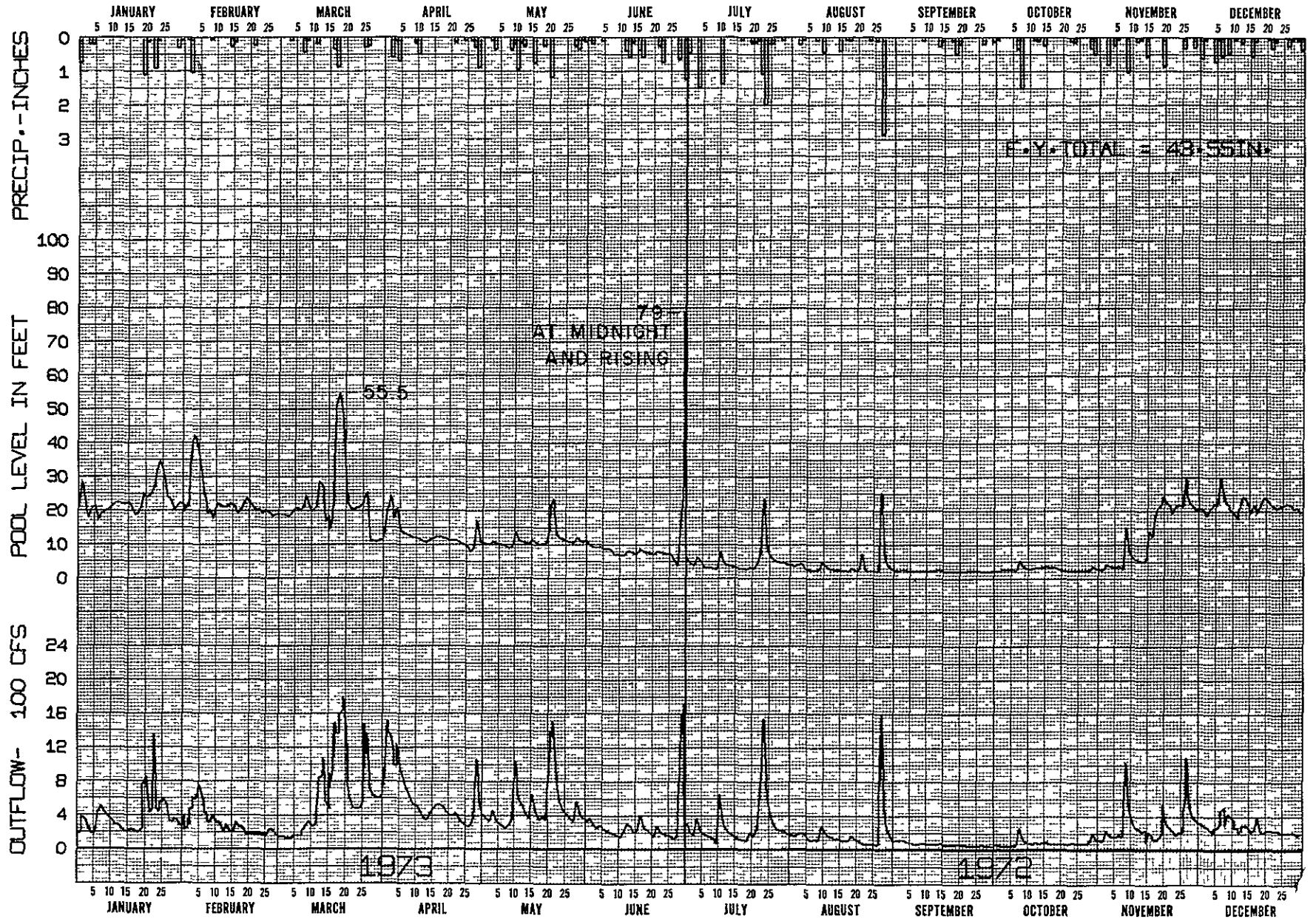


PLATE 5

RESERVOIR OPERATIONS - UNION VILLAGE DAM
F.Y. 1973

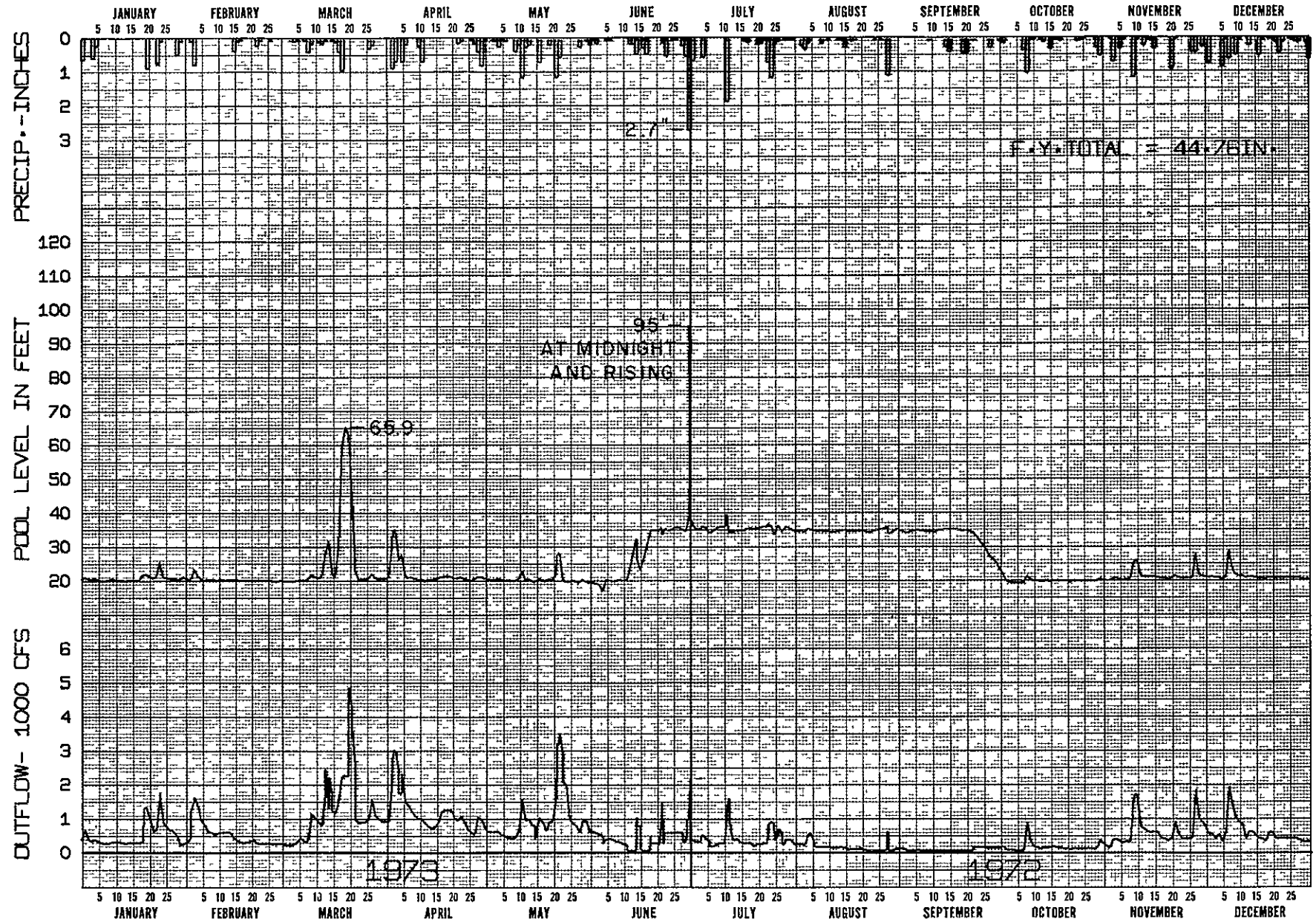


PLATE 6

RESERVOIR OPERATIONS - NORTH HARTLAND LAKE
F.Y. 1973

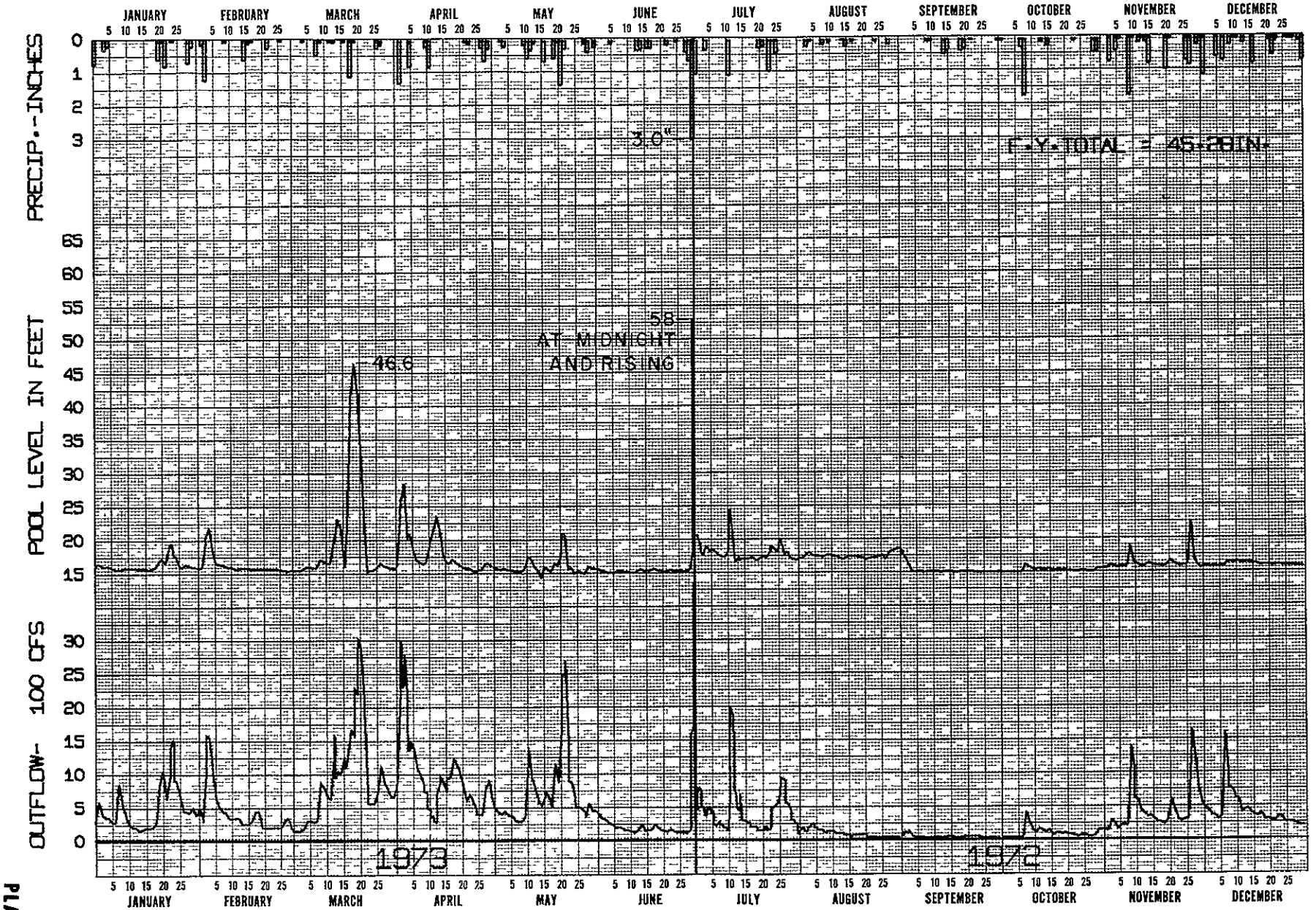


PLATE 7

RESERVOIR OPERATIONS - NORTH SPRINGFIELD LAKE
F.Y. 1973

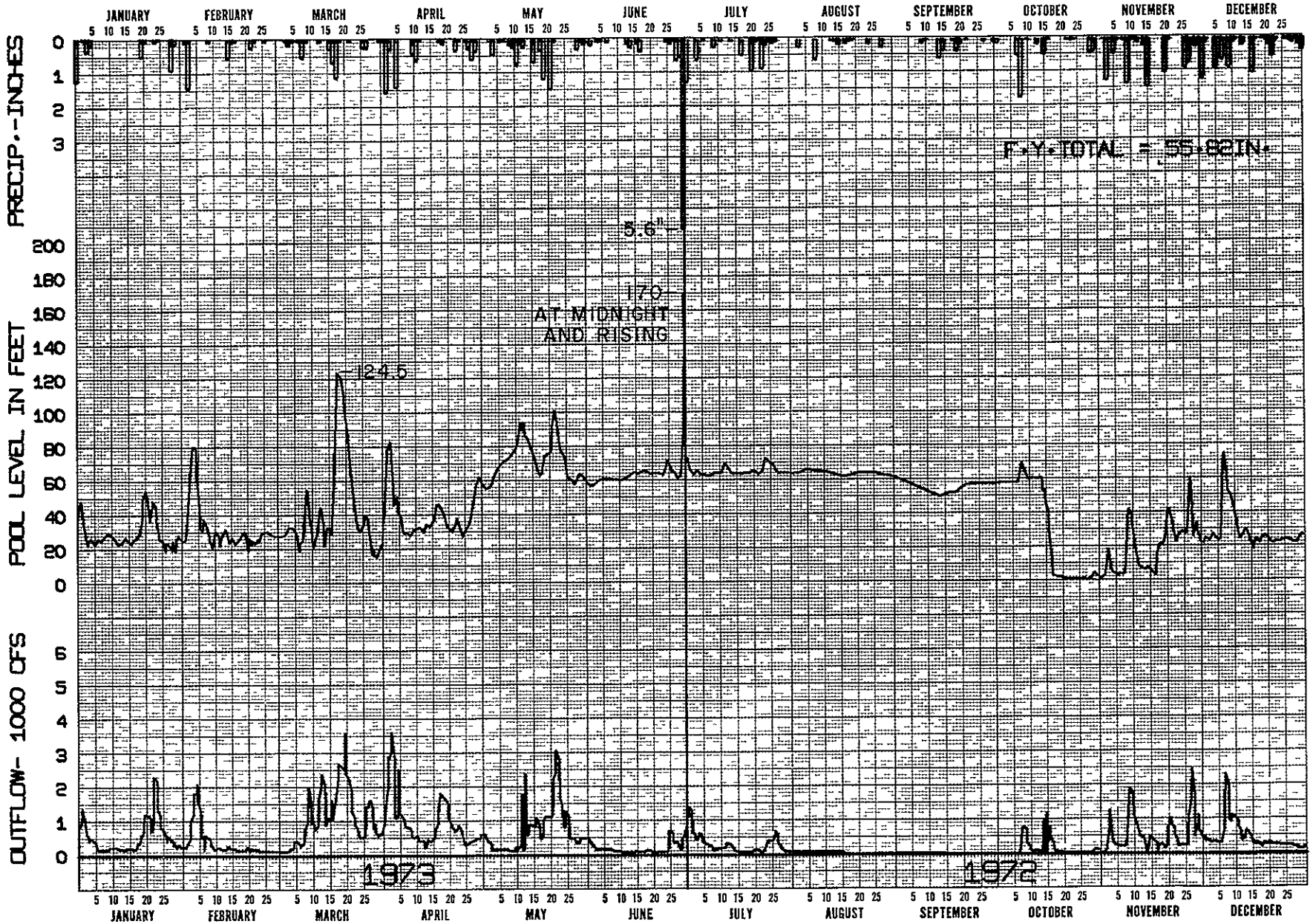


PLATE 8

RESERVOIR OPERATIONS - BALL MOUNTAIN LAKE
F.Y. 1973

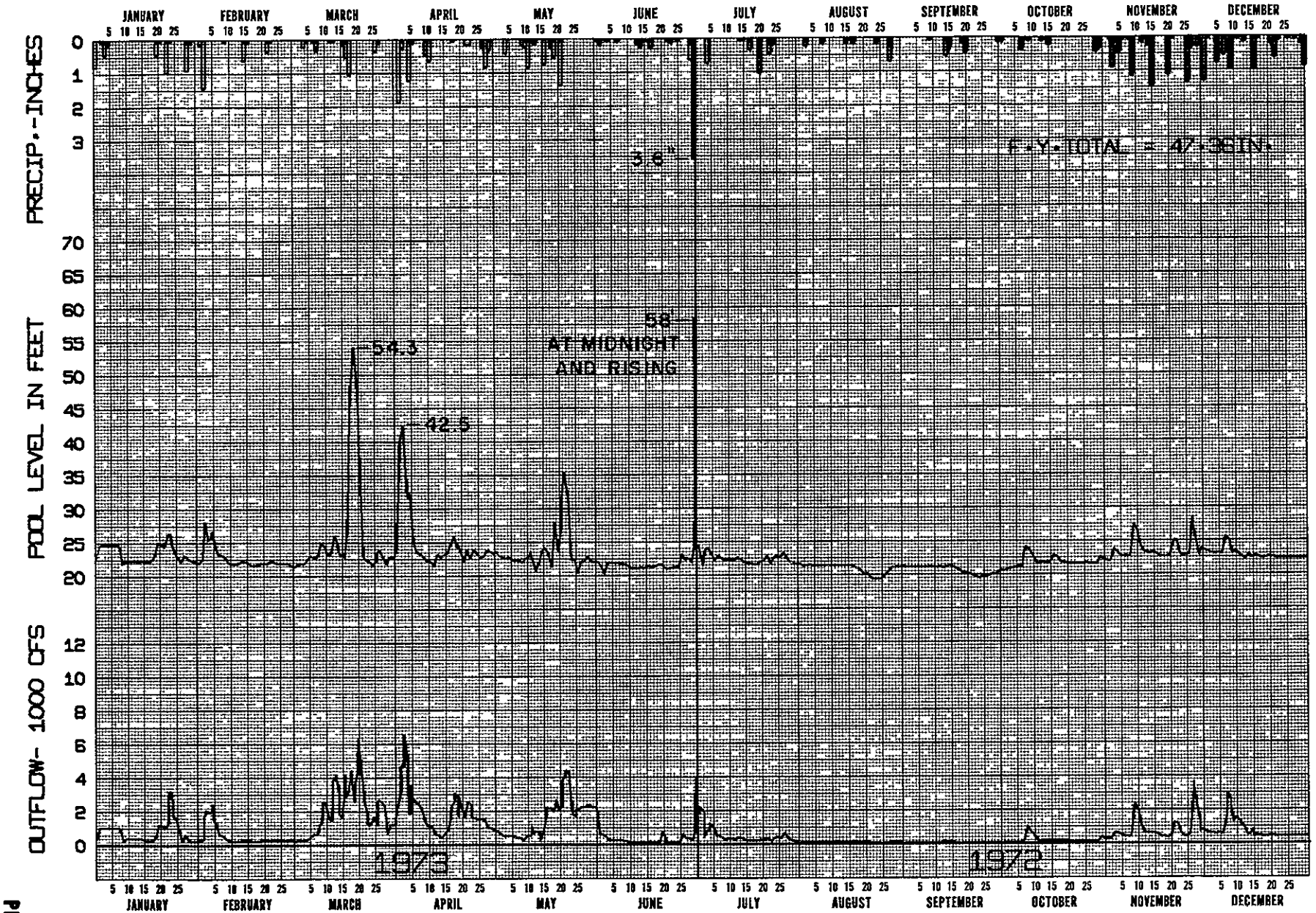


PLATE 9

RESERVOIR OPERATIONS - TOWNSHEND LAKE
F.Y. 1973

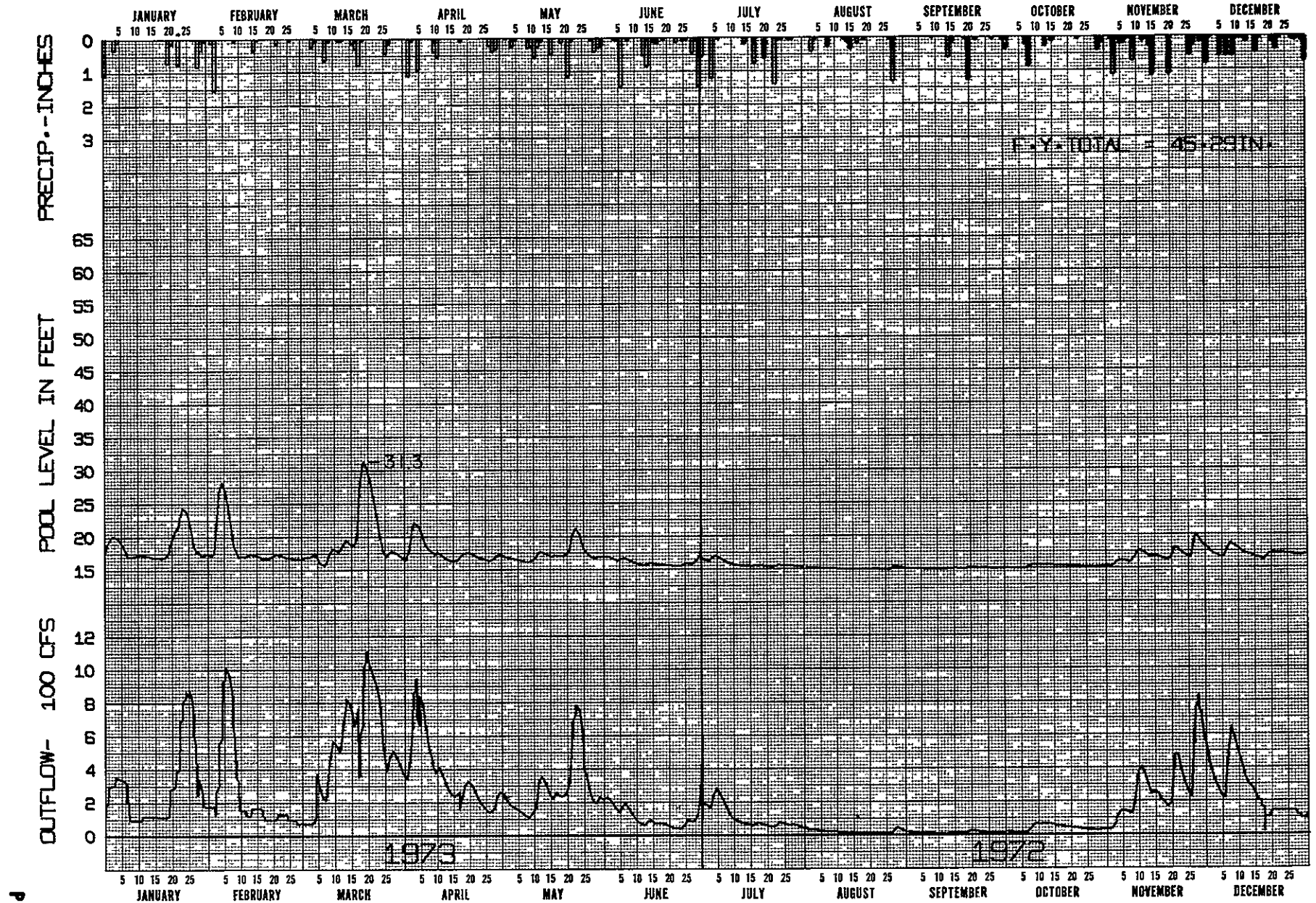


PLATE 10

RESERVOIR OPERATIONS - SURRY MOUNTAIN LAKE
F.Y. 1973

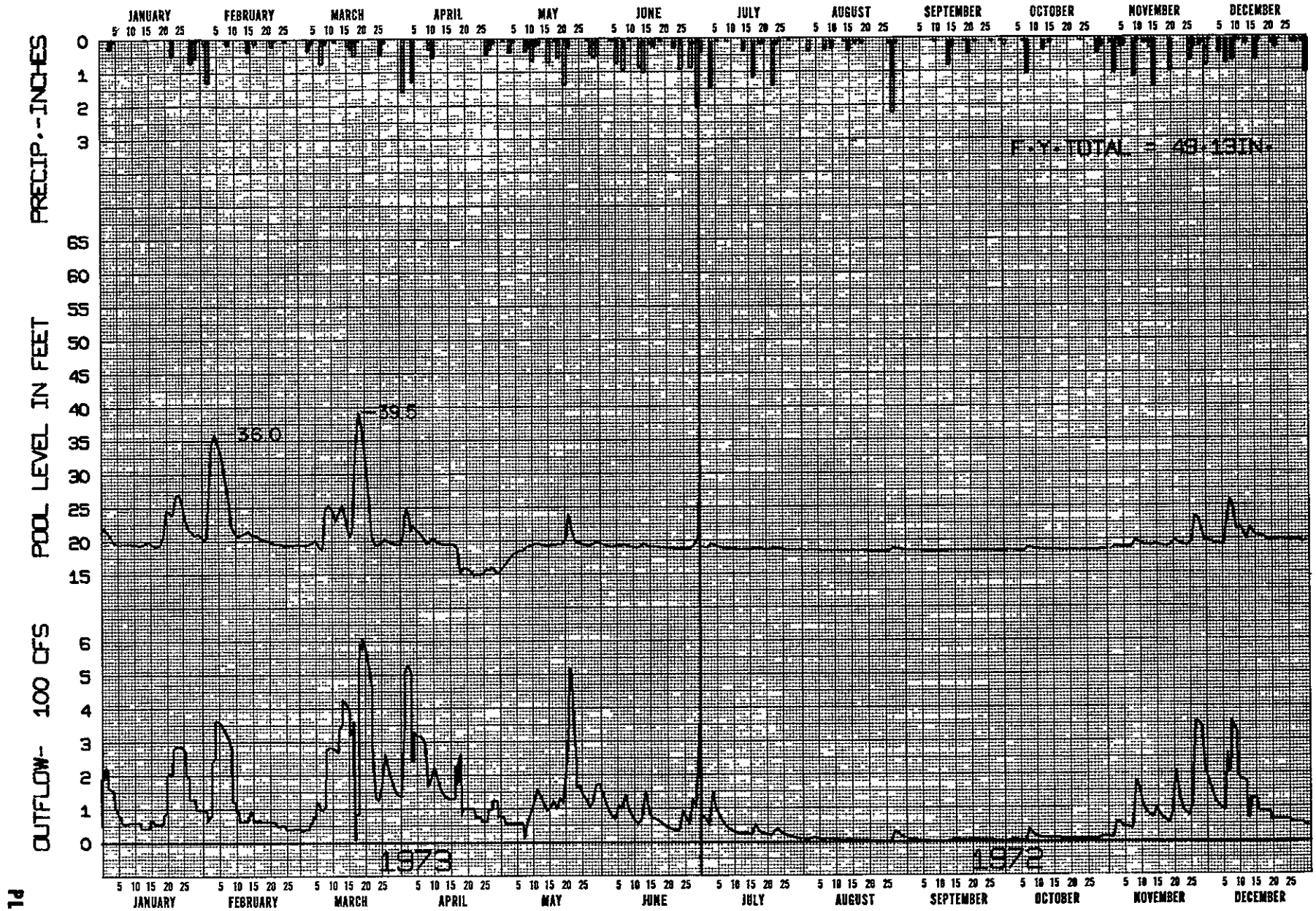
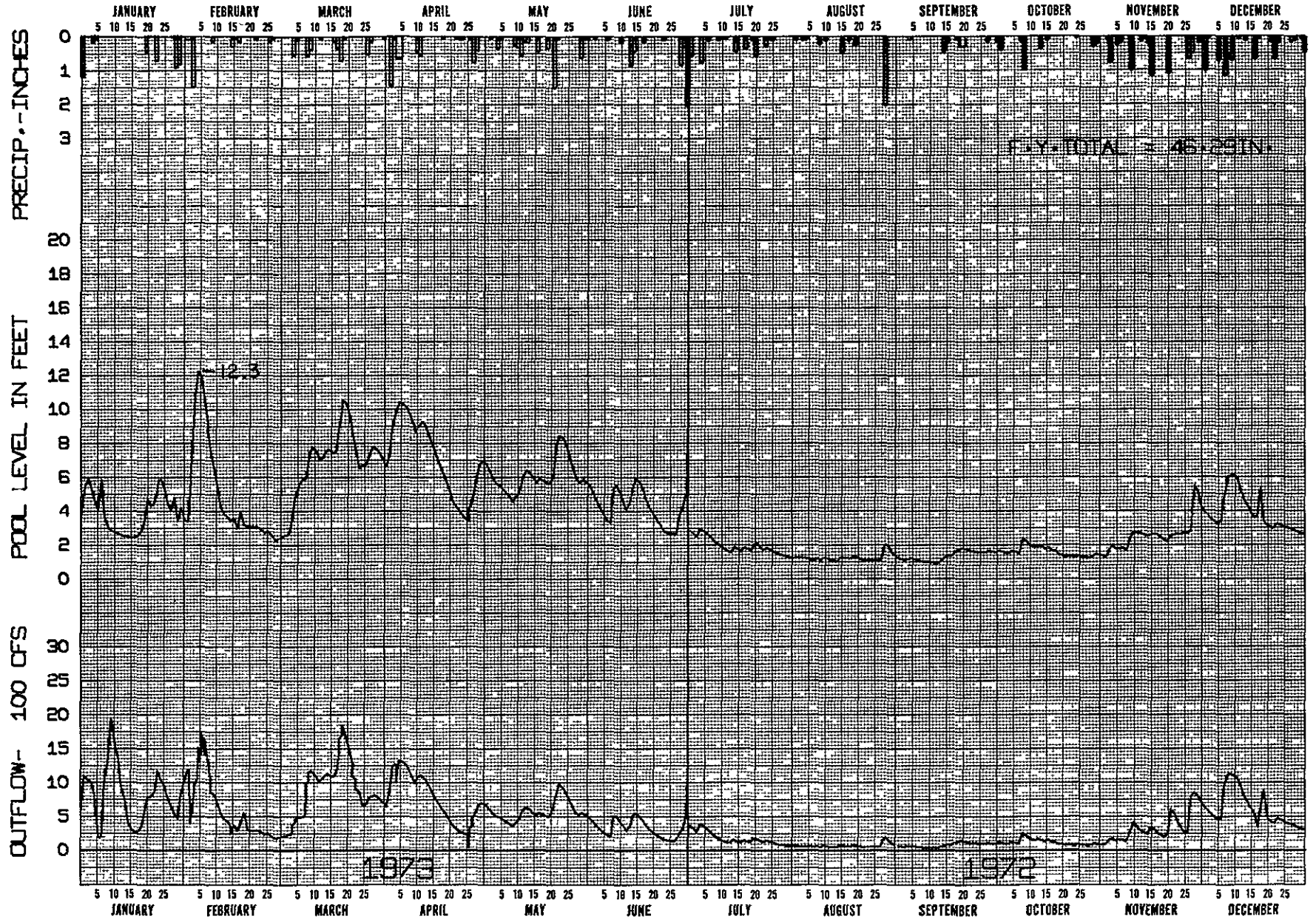


PLATE II

RESERVOIR OPERATIONS - OTTER BROOK LAKE
F.Y. 1973



RESERVOIR OPERATIONS - BIRCH HILL DAM
F.Y. 1973

PLATE 12

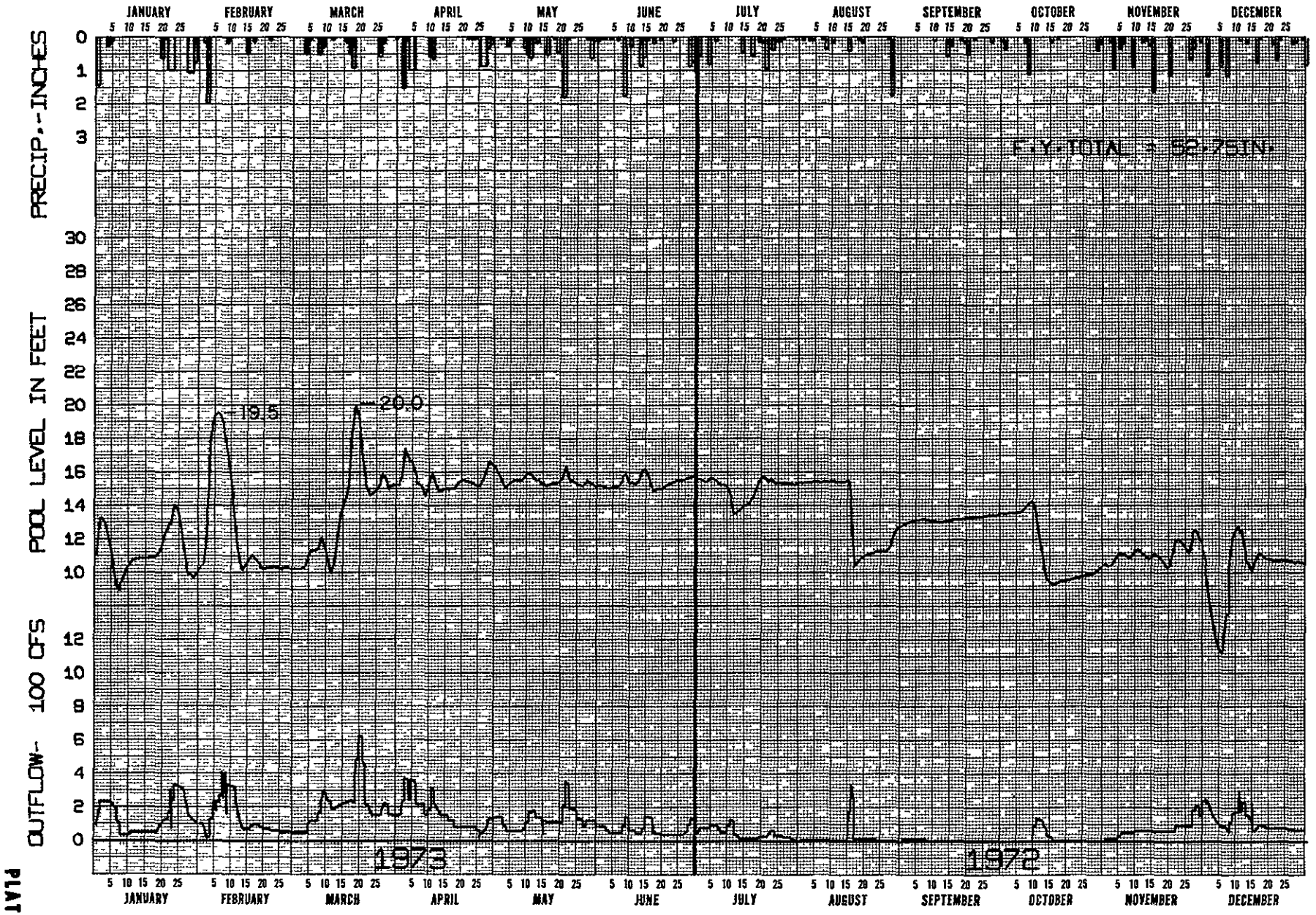


PLATE 13

RESERVOIR OPERATIONS - TULLY LAKE
F.Y. 1973

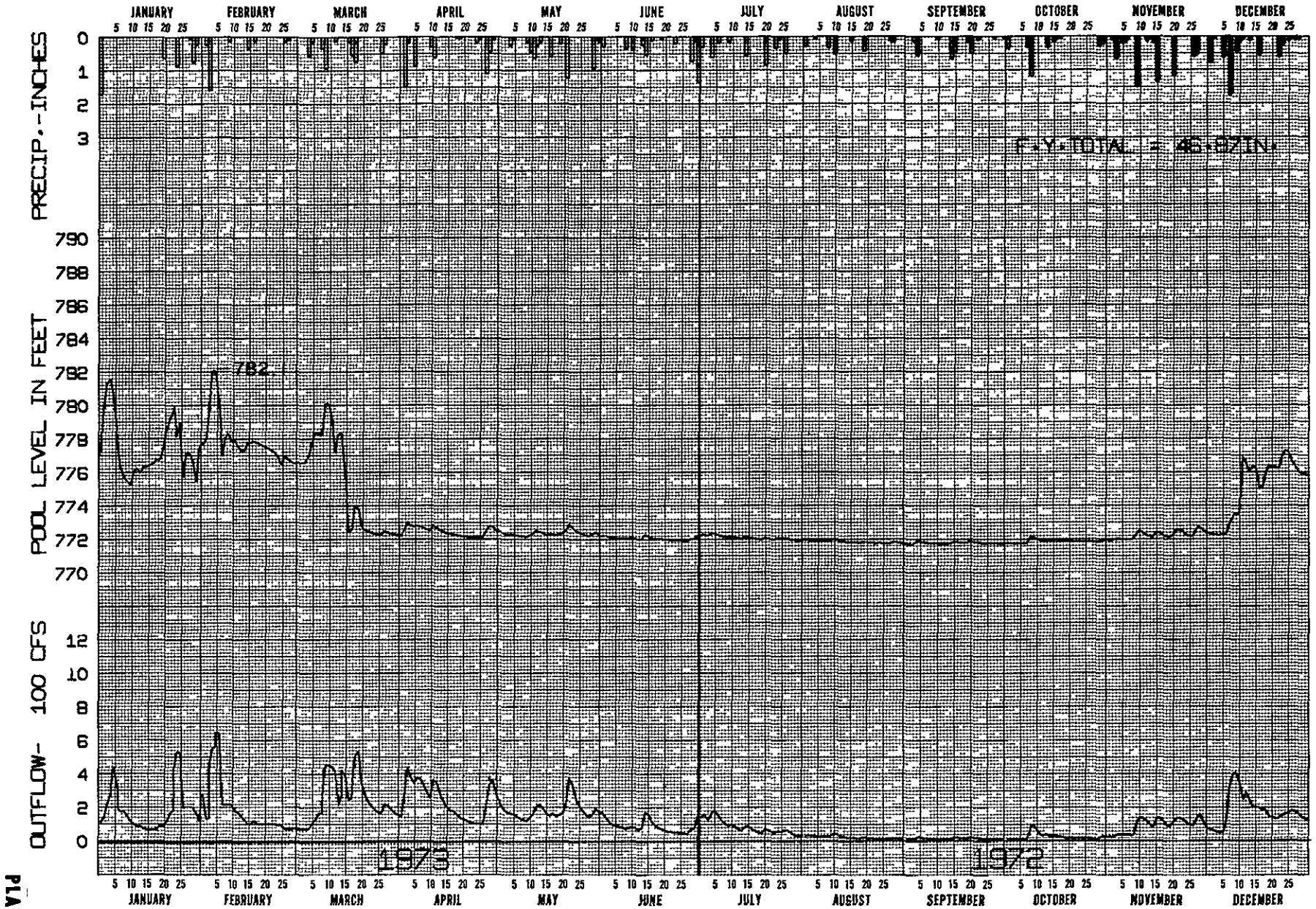


PLATE 14

RESERVOIR OPERATIONS - BARRE FALLS DAM
F.Y. 1973

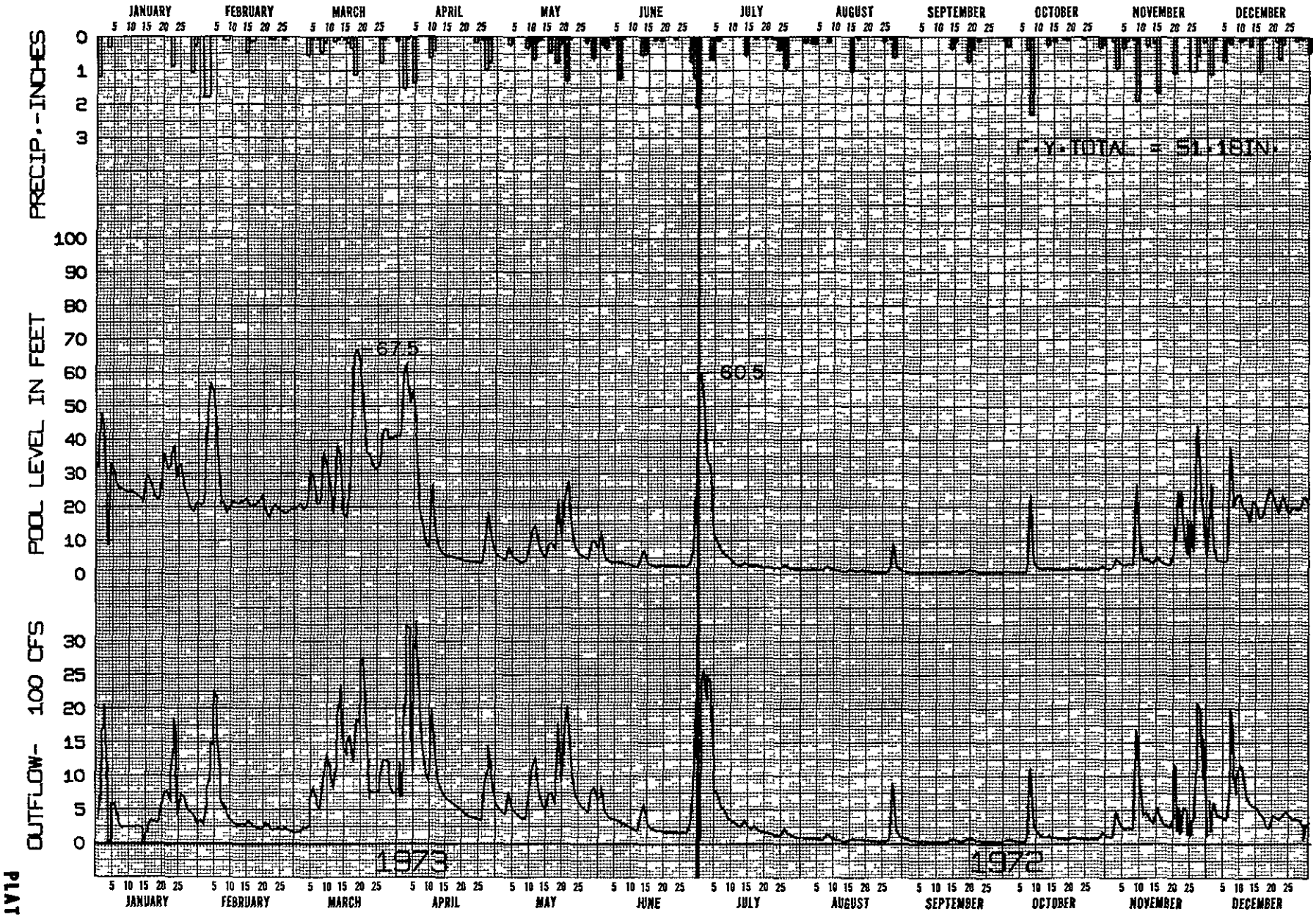


PLATE 15

RESERVOIR OPERATIONS - KNIGHTVILLE DAM
F.Y. 1973

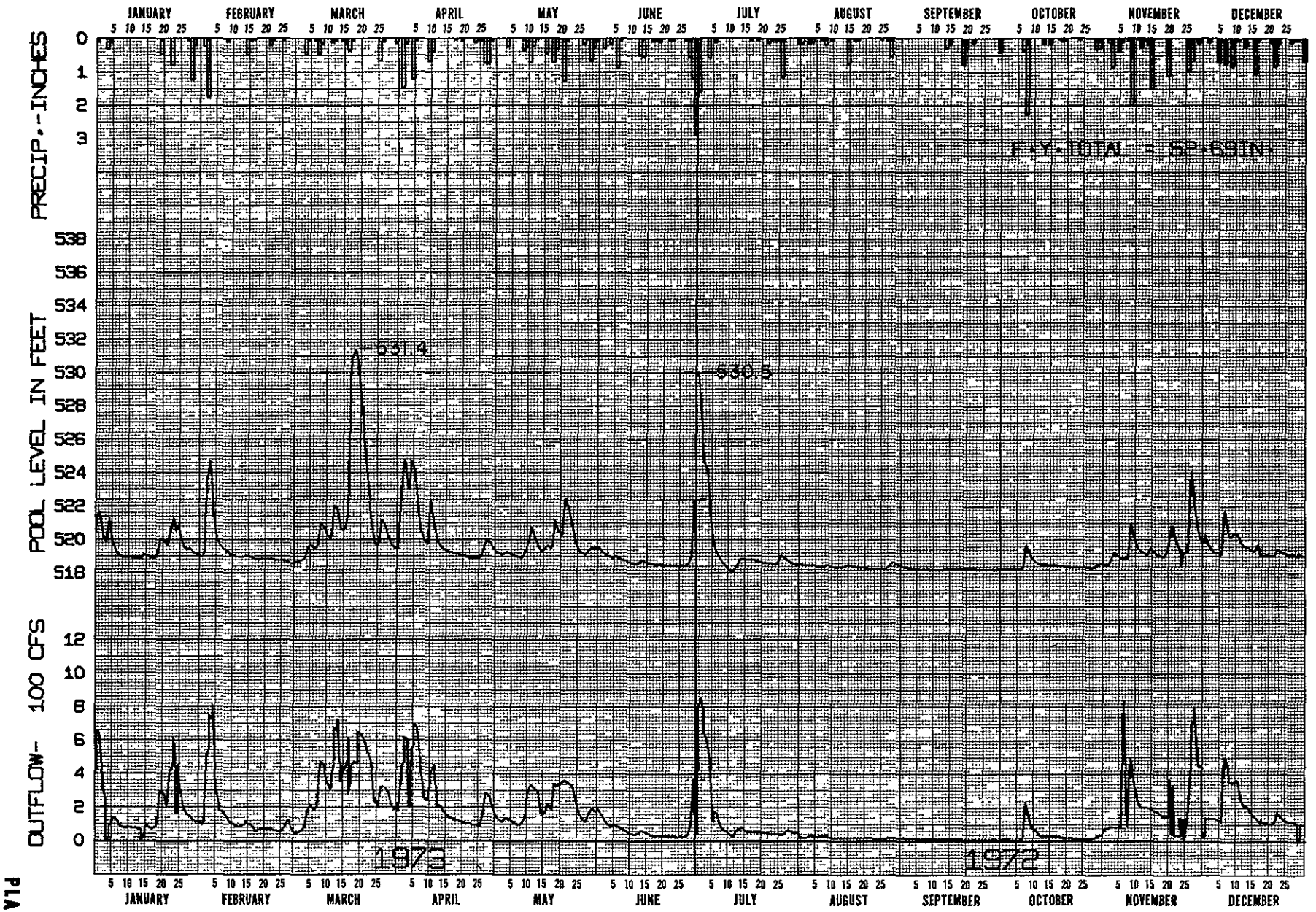


PLATE 16

RESERVOIR OPERATIONS - LITTLEVILLE LAKE
F.Y. 1973

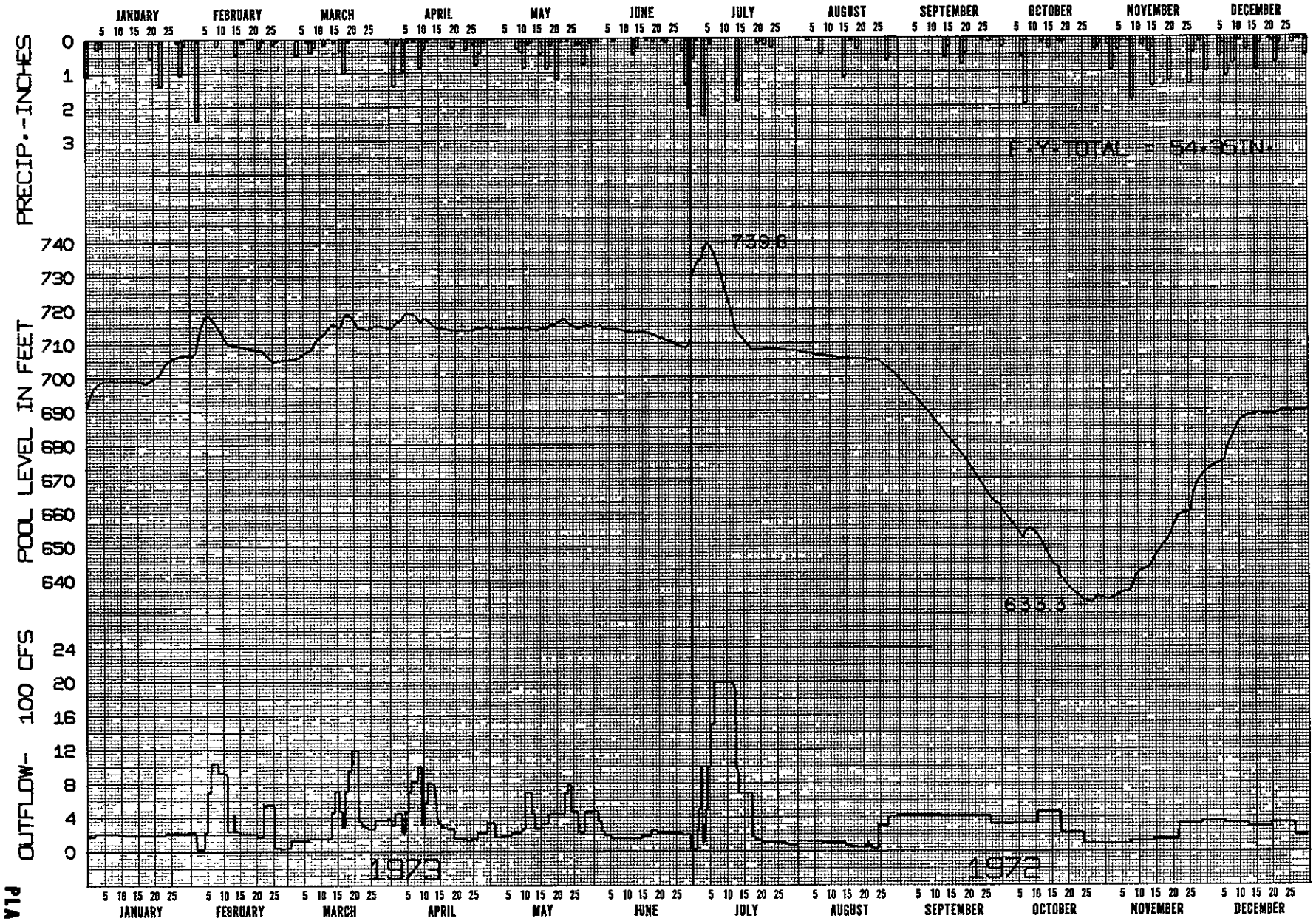


PLATE 17

RESERVOIR OPERATIONS - COLEBROOK RIVER LAKE
F. Y. 1973

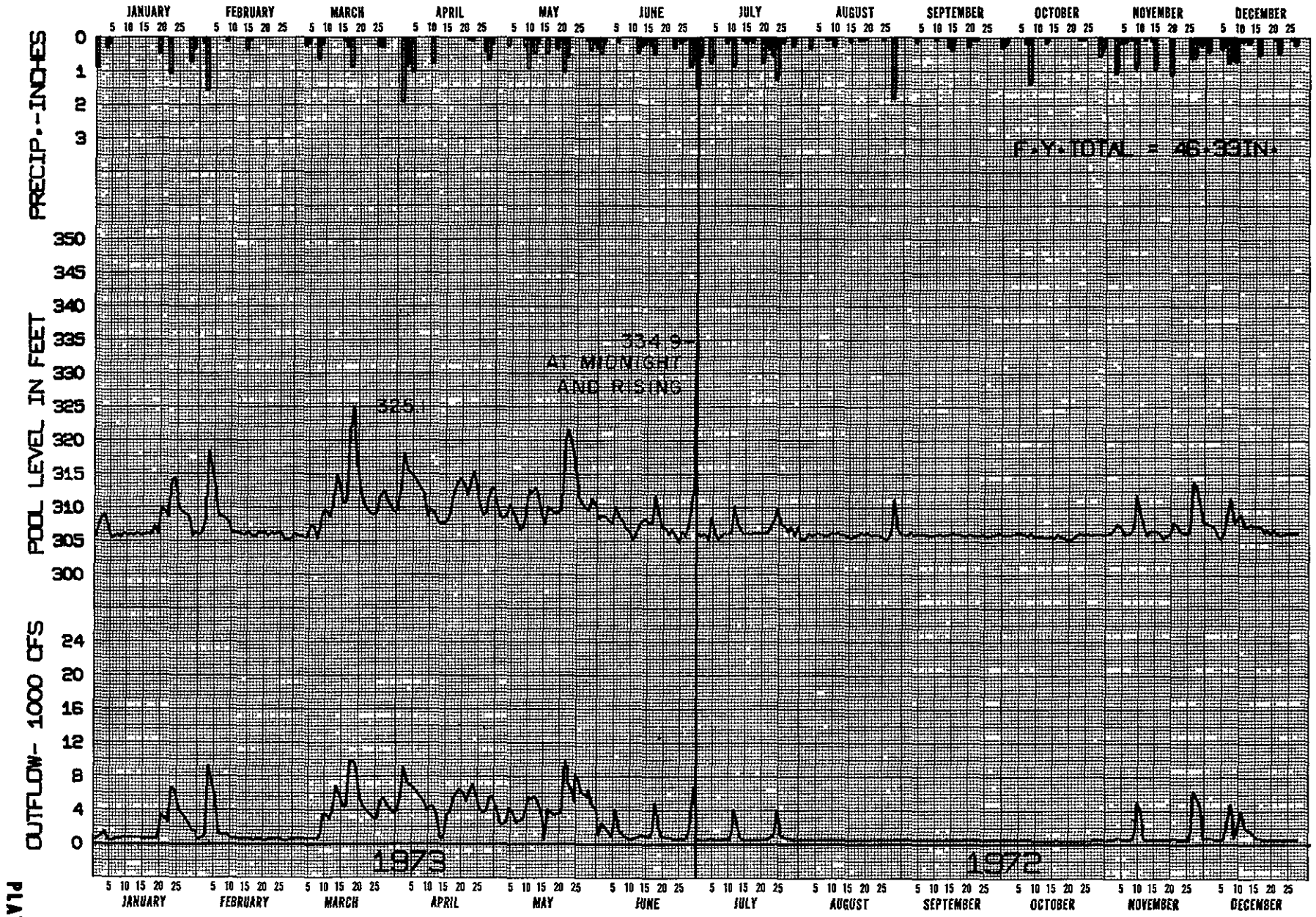


PLATE 18

RESERVOIR OPERATIONS - FRANKLIN FALLS DAM
F.Y. 1973

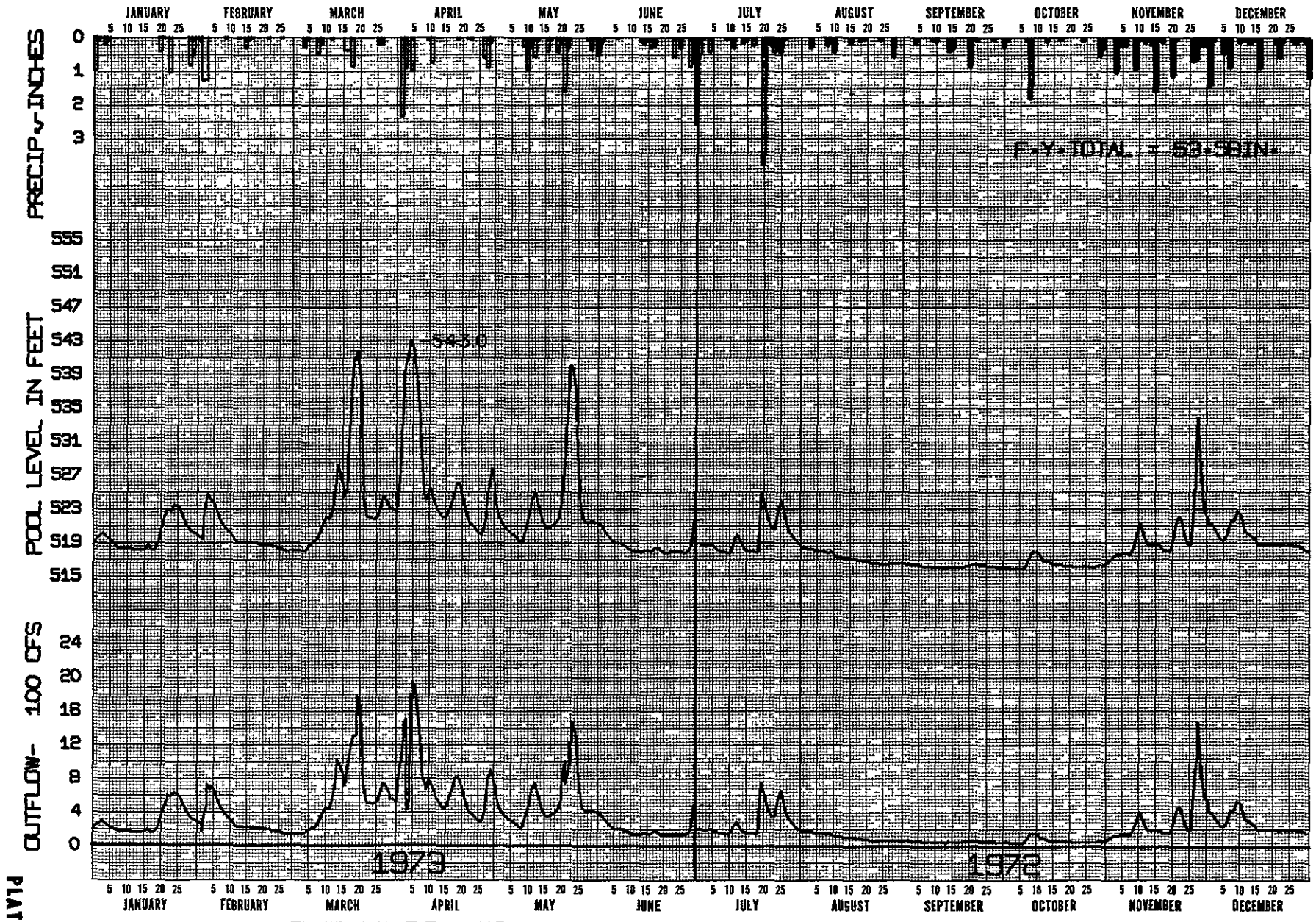


PLATE 19

RESERVOIR OPERATIONS - BLACKWATER DAM
F.Y. 1973

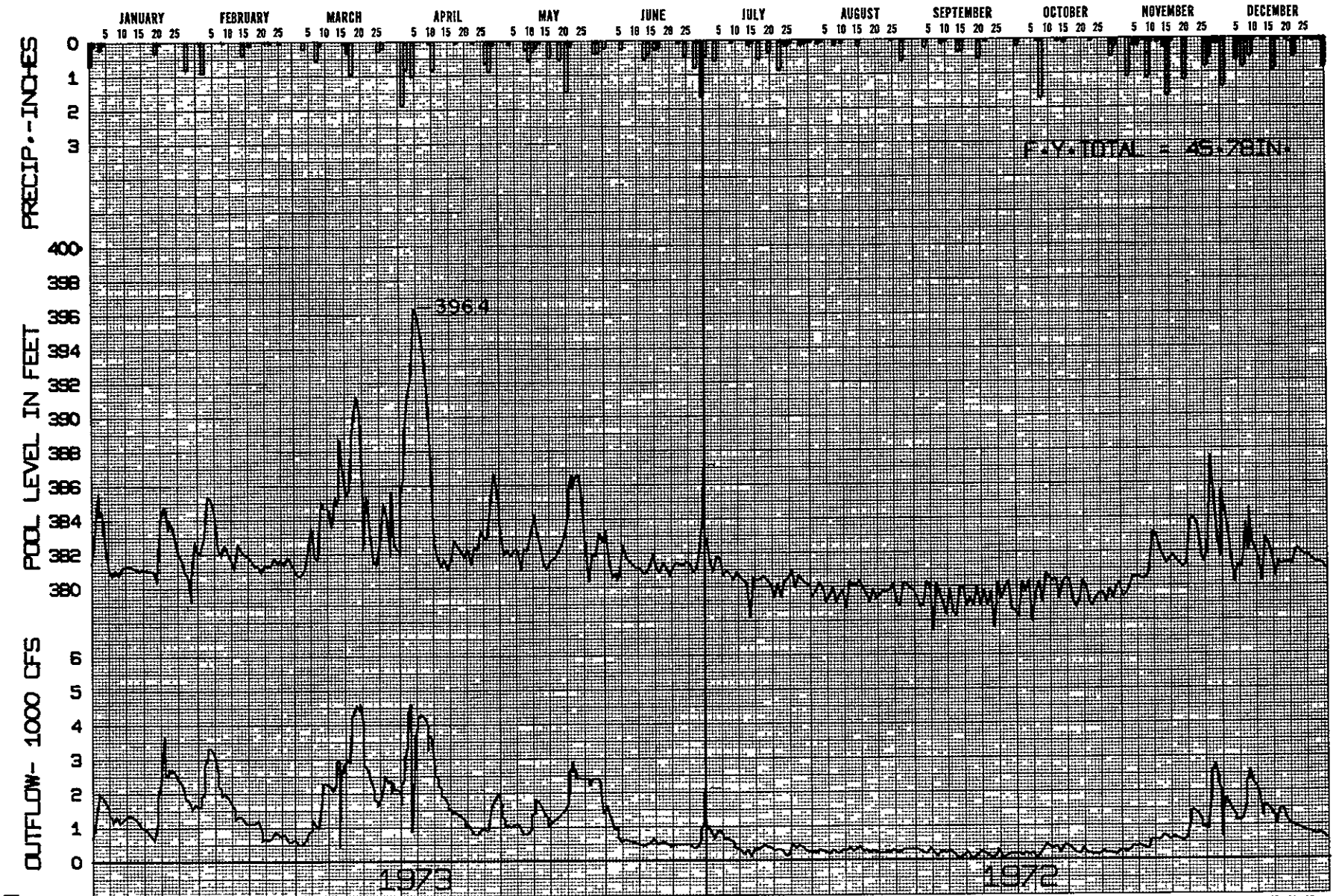


PLATE 20

RESERVOIR OPERATIONS - HOPKINTON LAKE
F.Y. 1973

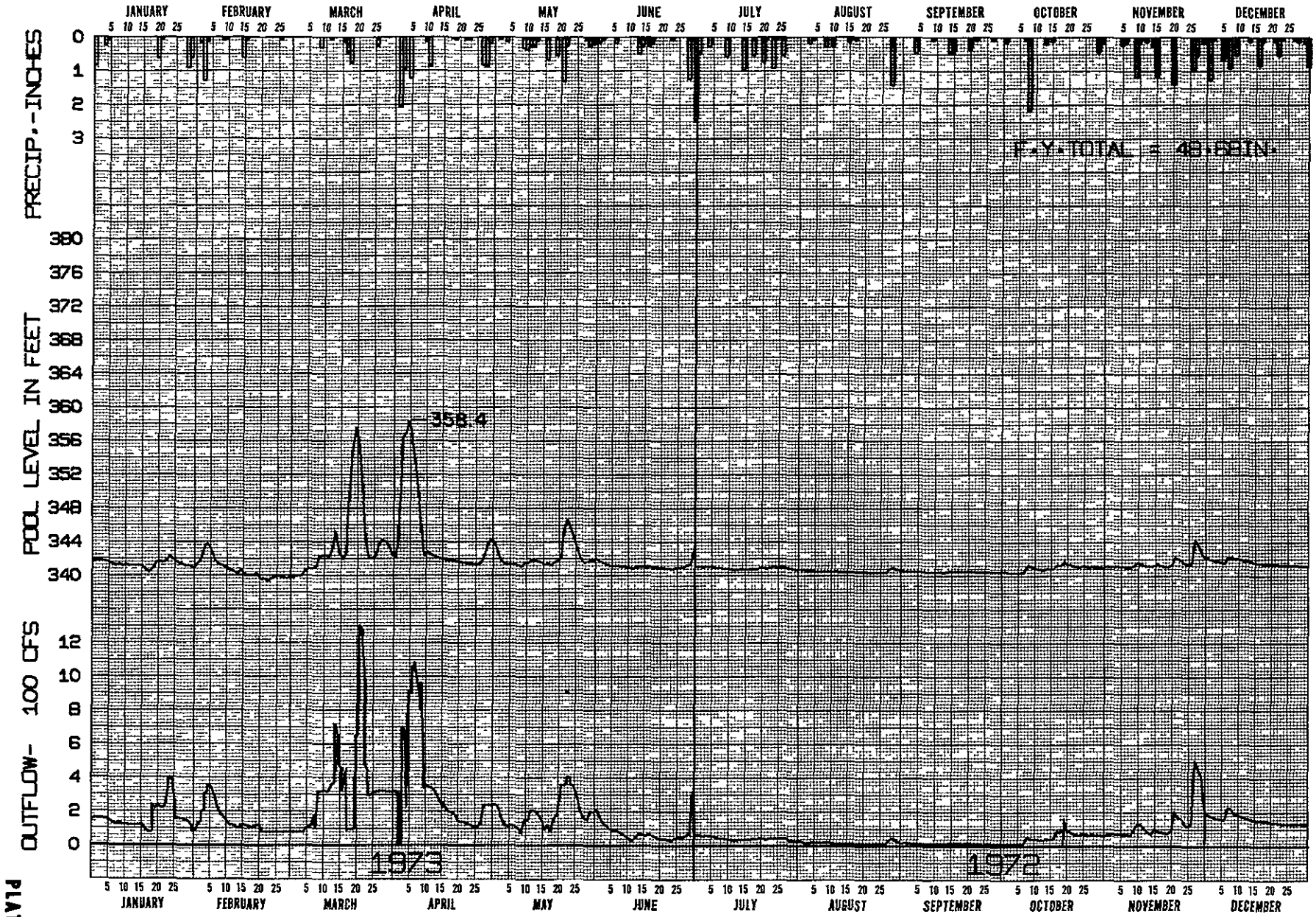


PLATE 21

RESERVOIR OPERATIONS - EVERETT LAKE
F.Y. 1973

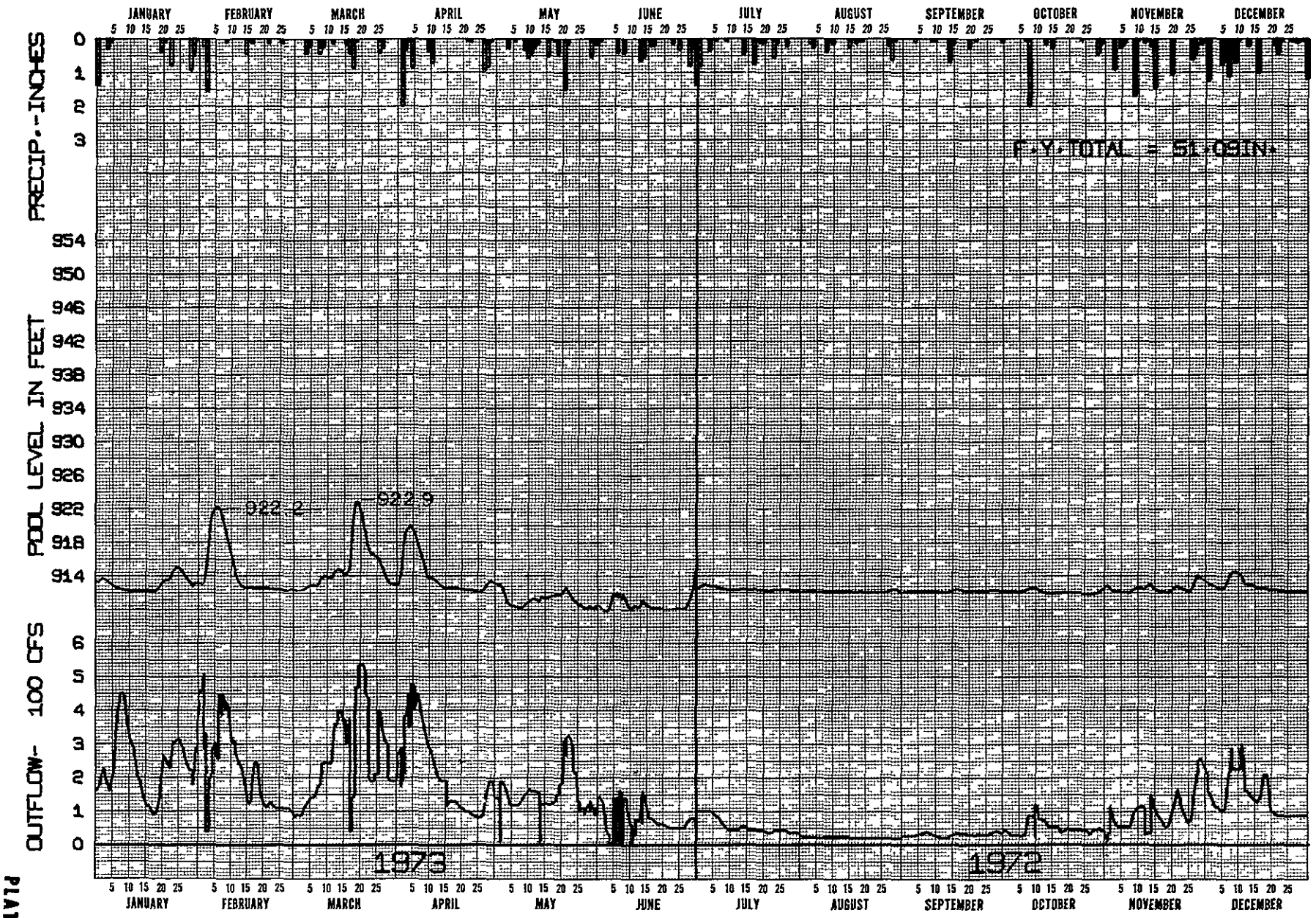


PLATE 22

RESERVOIR OPERATIONS - EDWARD MACDOWELL DAM
F.Y. 1973

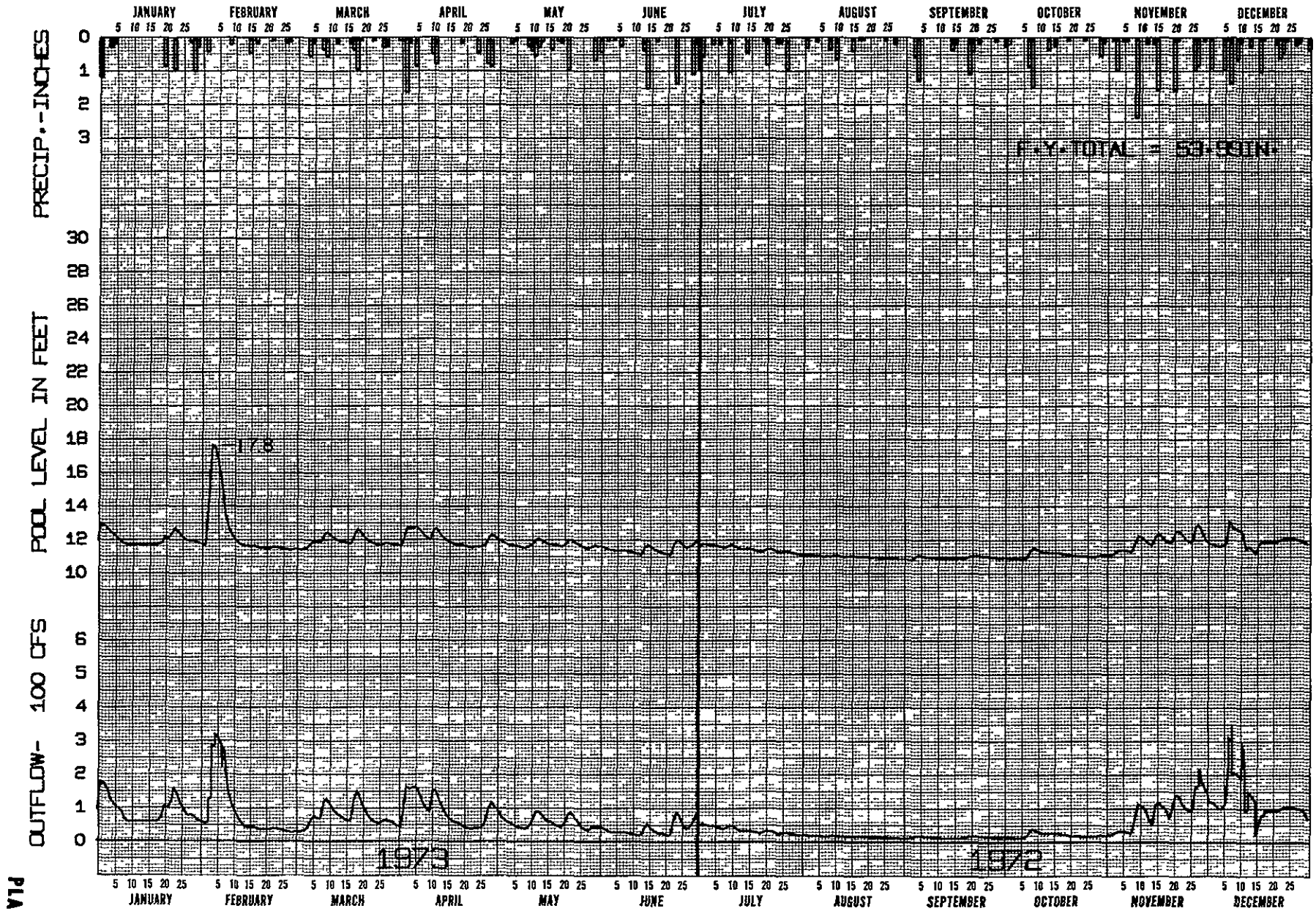


PLATE 23

RESERVOIR OPERATIONS - BUFFUMVILLE LAKE
F.Y. 1973

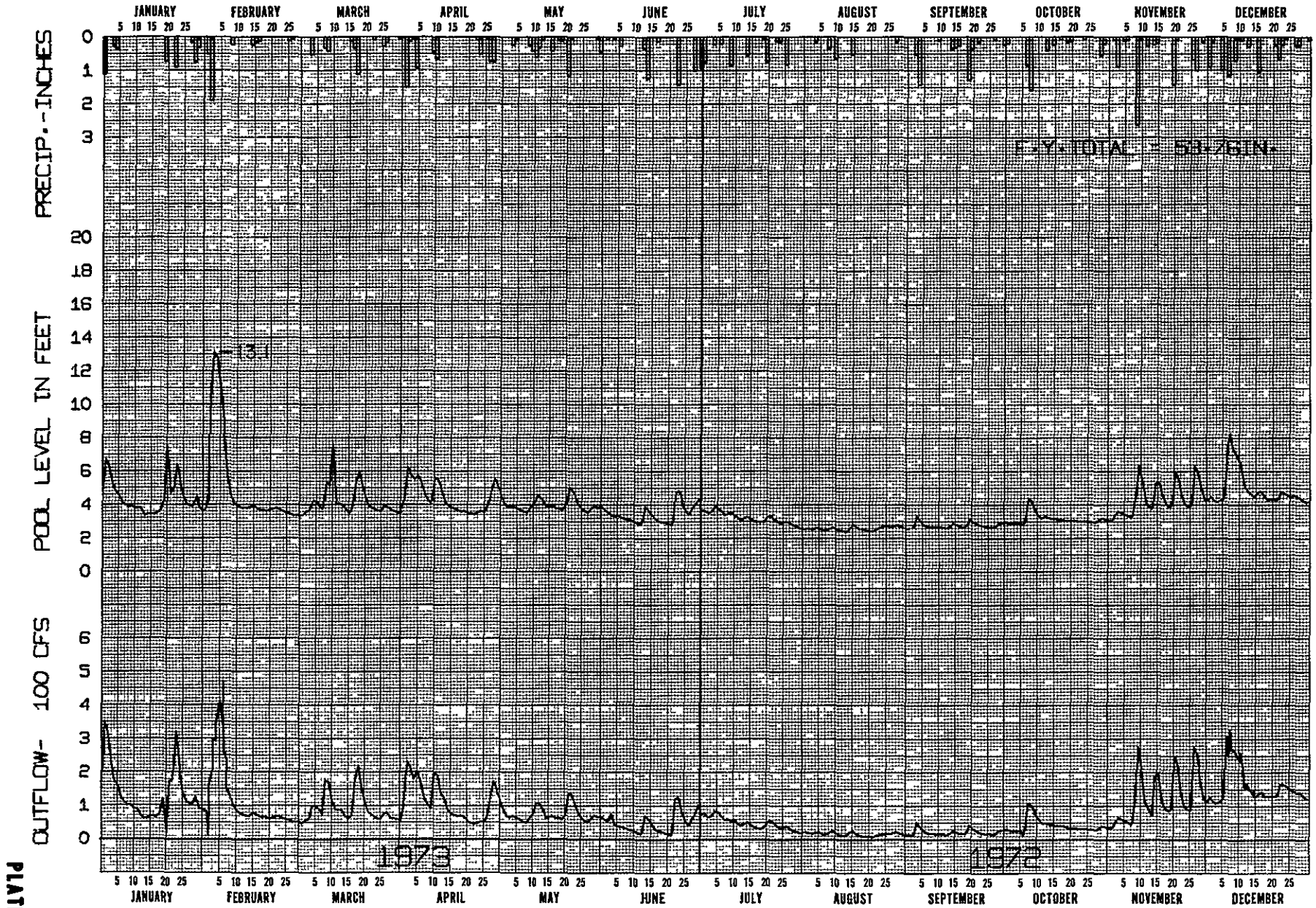
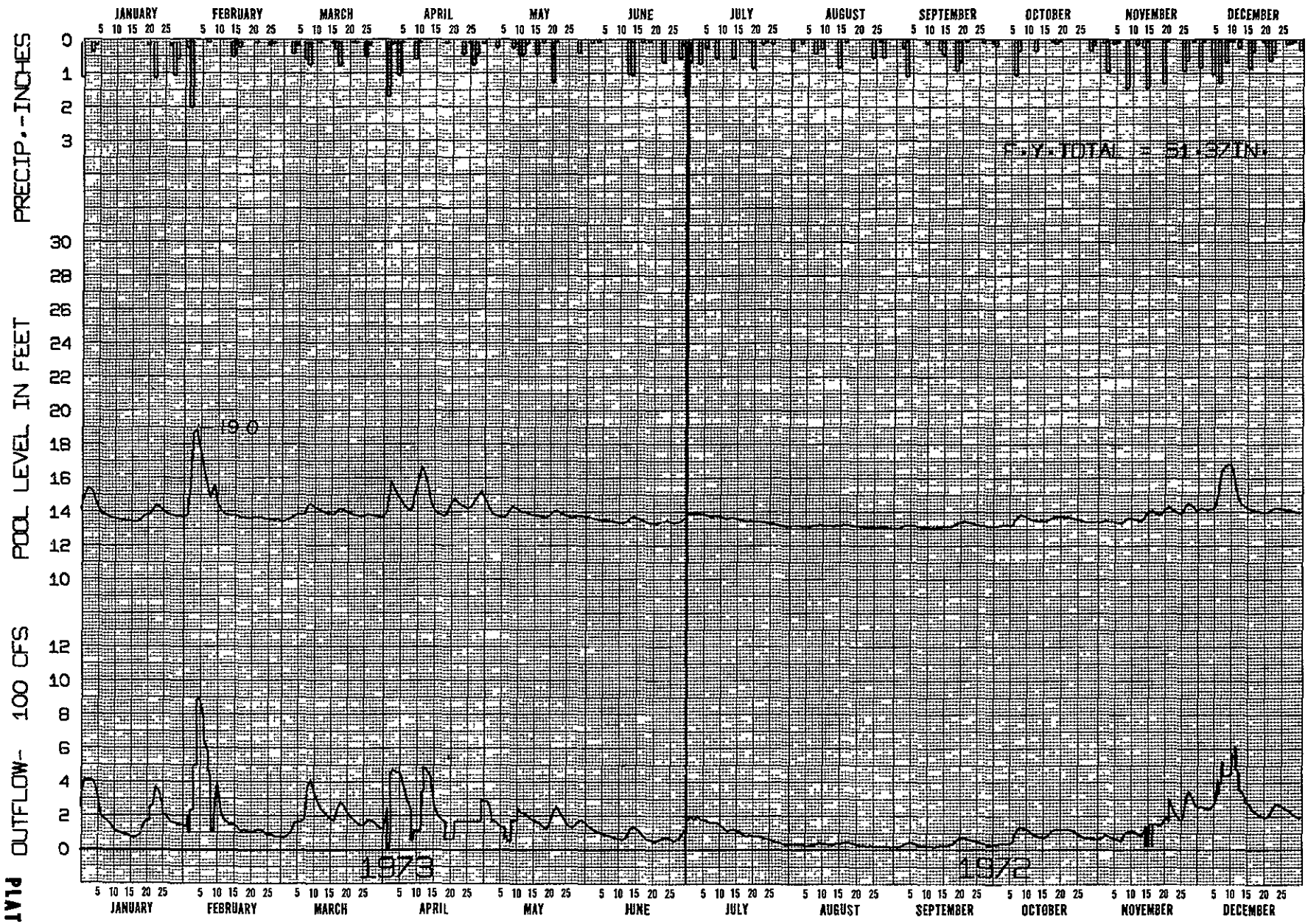


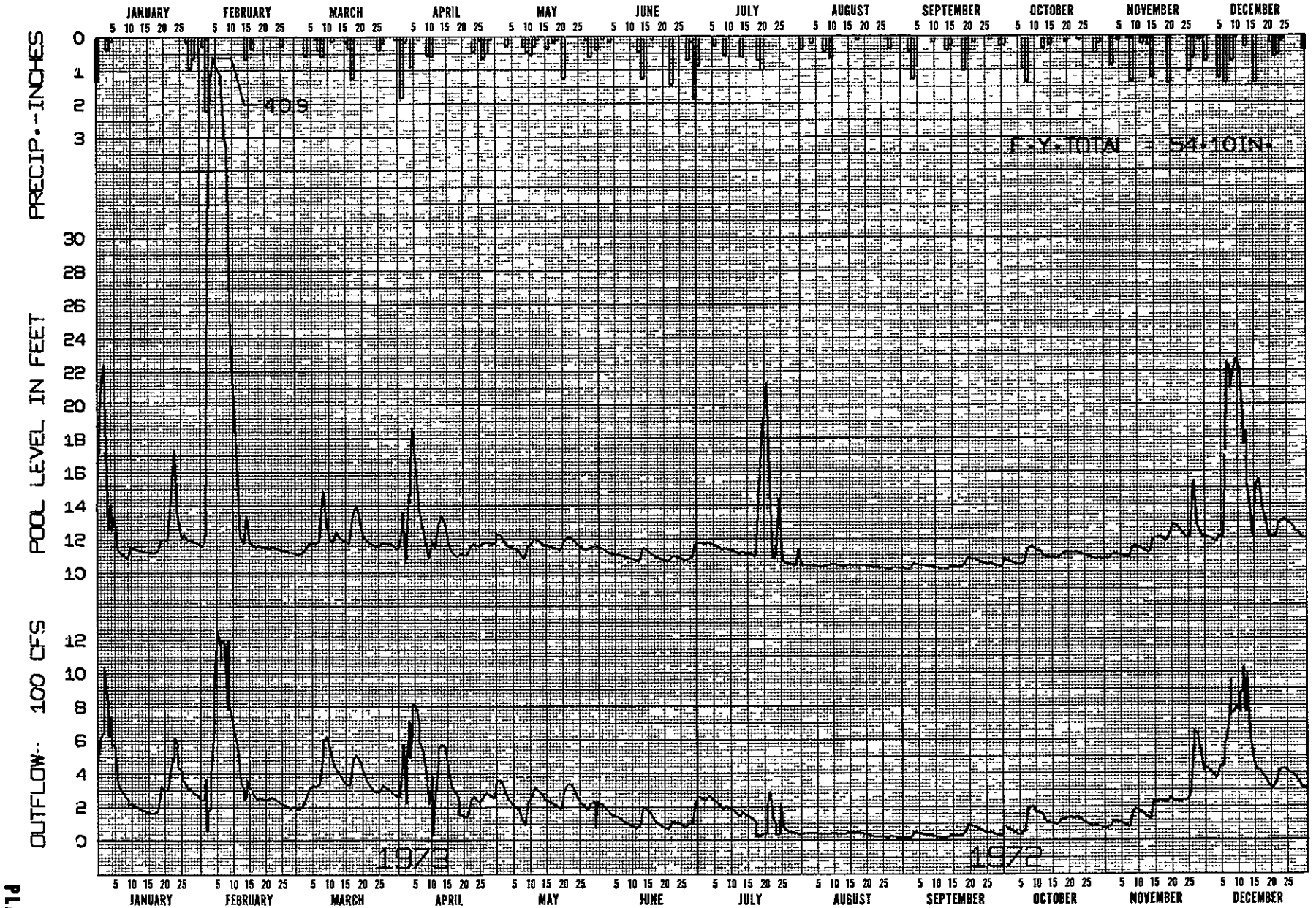
PLATE 24

RESERVOIR OPERATIONS - HODGES VILLAGE DAM .
F.Y. 1973



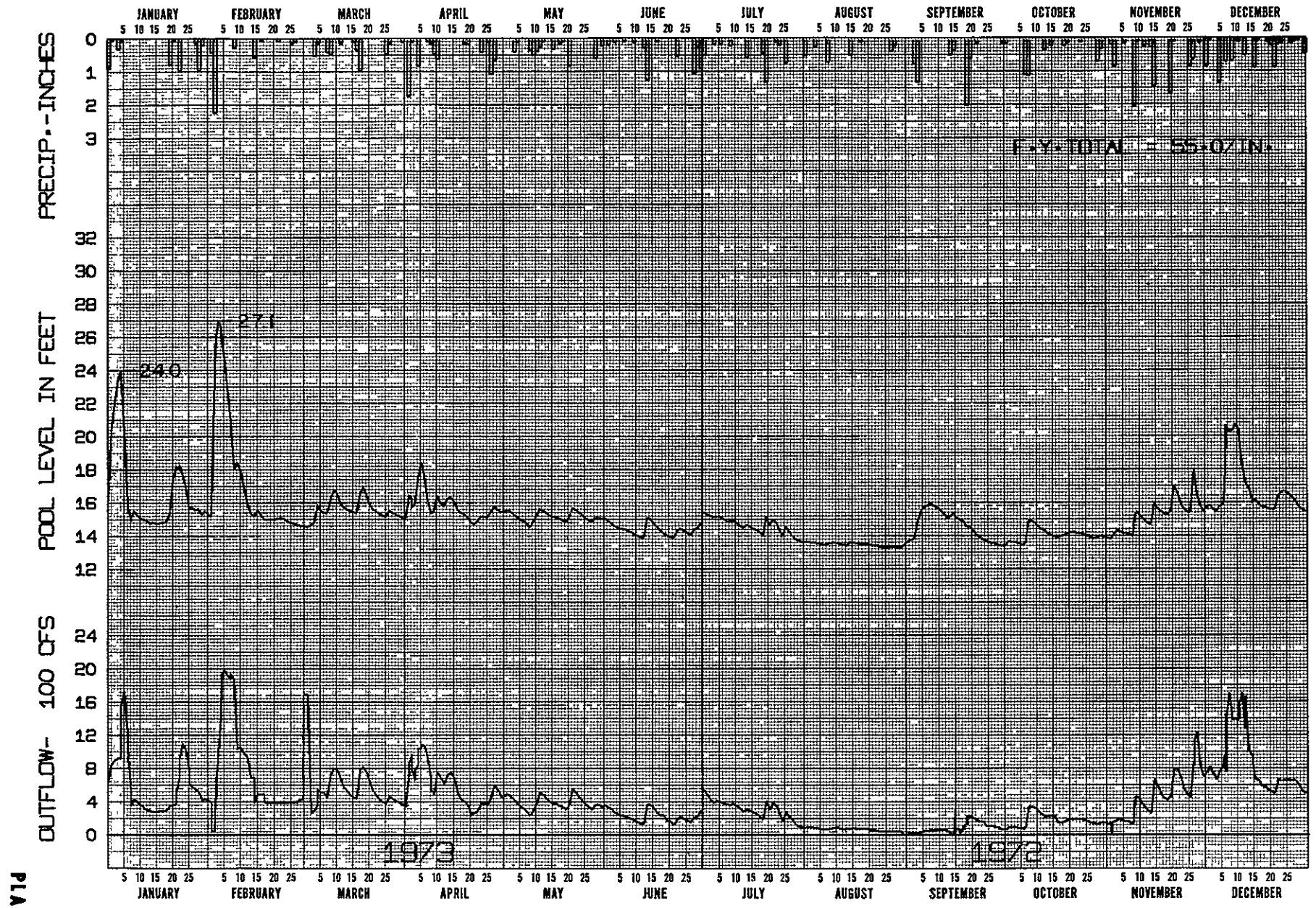
RESERVOIR OPERATIONS - EAST BRIMFIELD LAKE
F.Y. 1973

PLATE 25



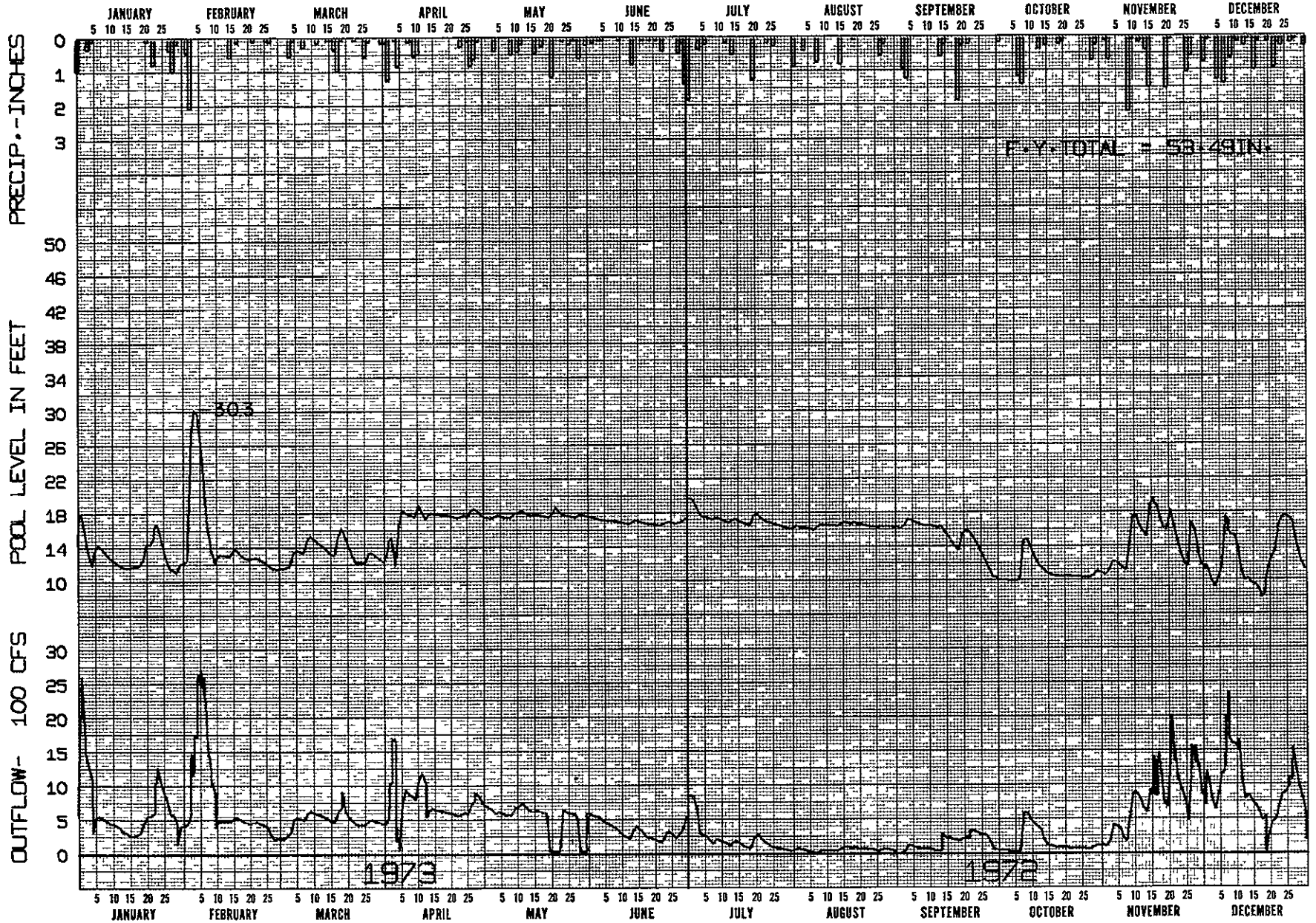
RESERVOIR OPERATIONS - WESTVILLE LAKE
F.Y. 1973

PLATE 26



RESERVOIR OPERATIONS - WEST THOMPSON LAKE
F.Y. 1973

PLATE 27



RESERVOIR OPERATIONS - MANSFIELD HOLLOW LAKE
F.Y. 1973

PLATE 28

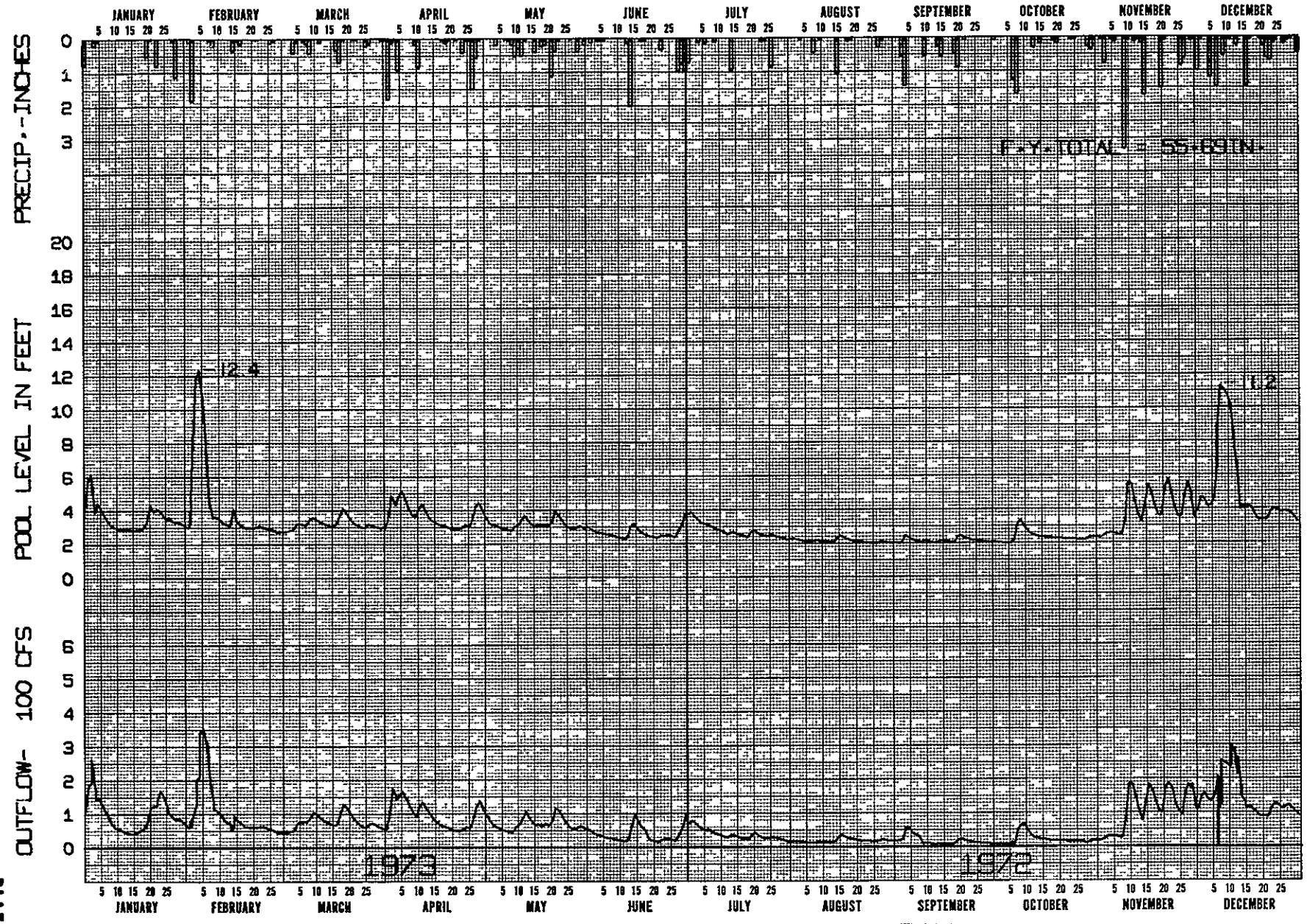


PLATE 29

RESERVOIR OPERATIONS - WEST HILL DAM
F.Y. 1973

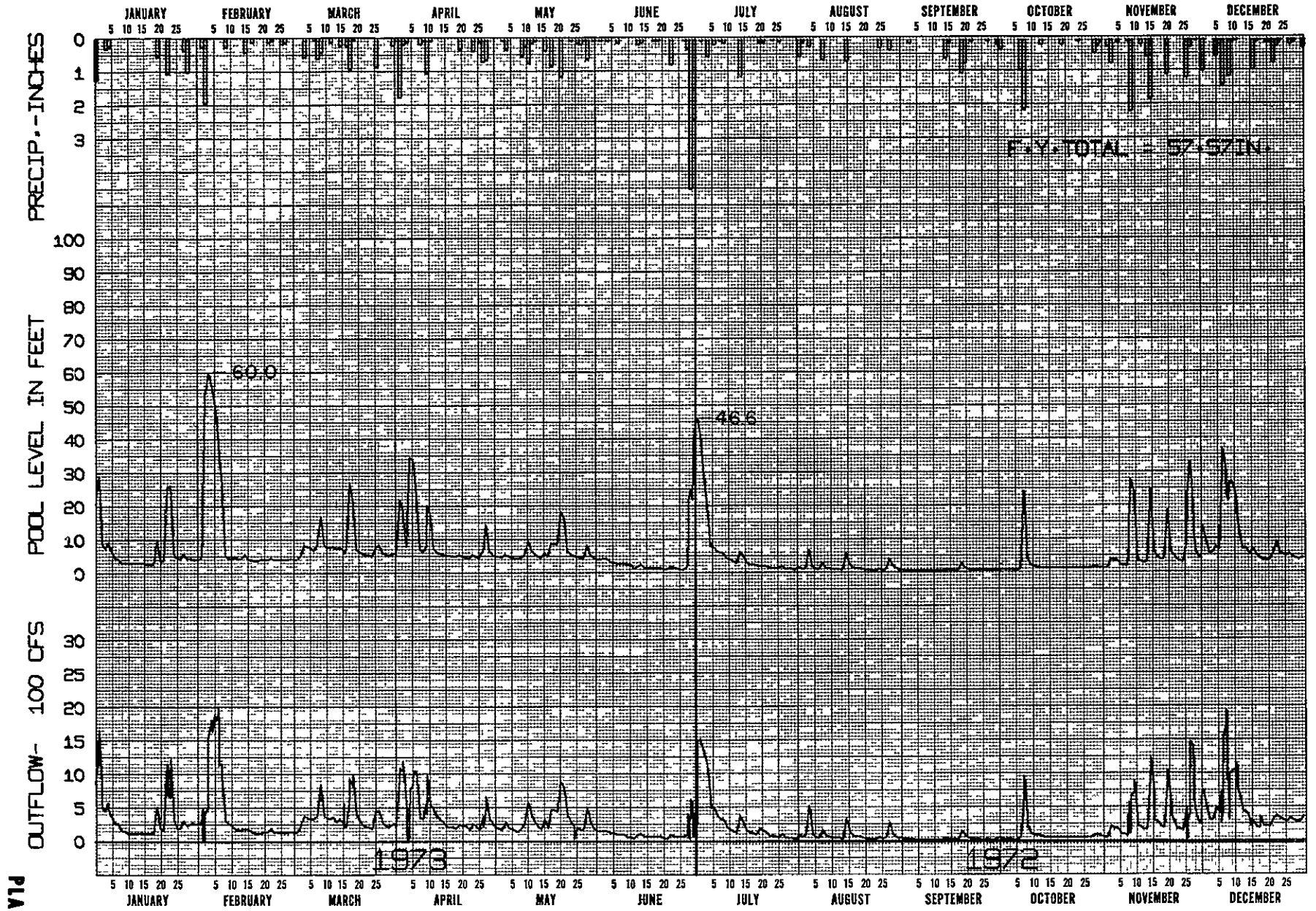


PLATE 30

RESERVOIR OPERATIONS - THOMASTON DAM
F. Y. 1973

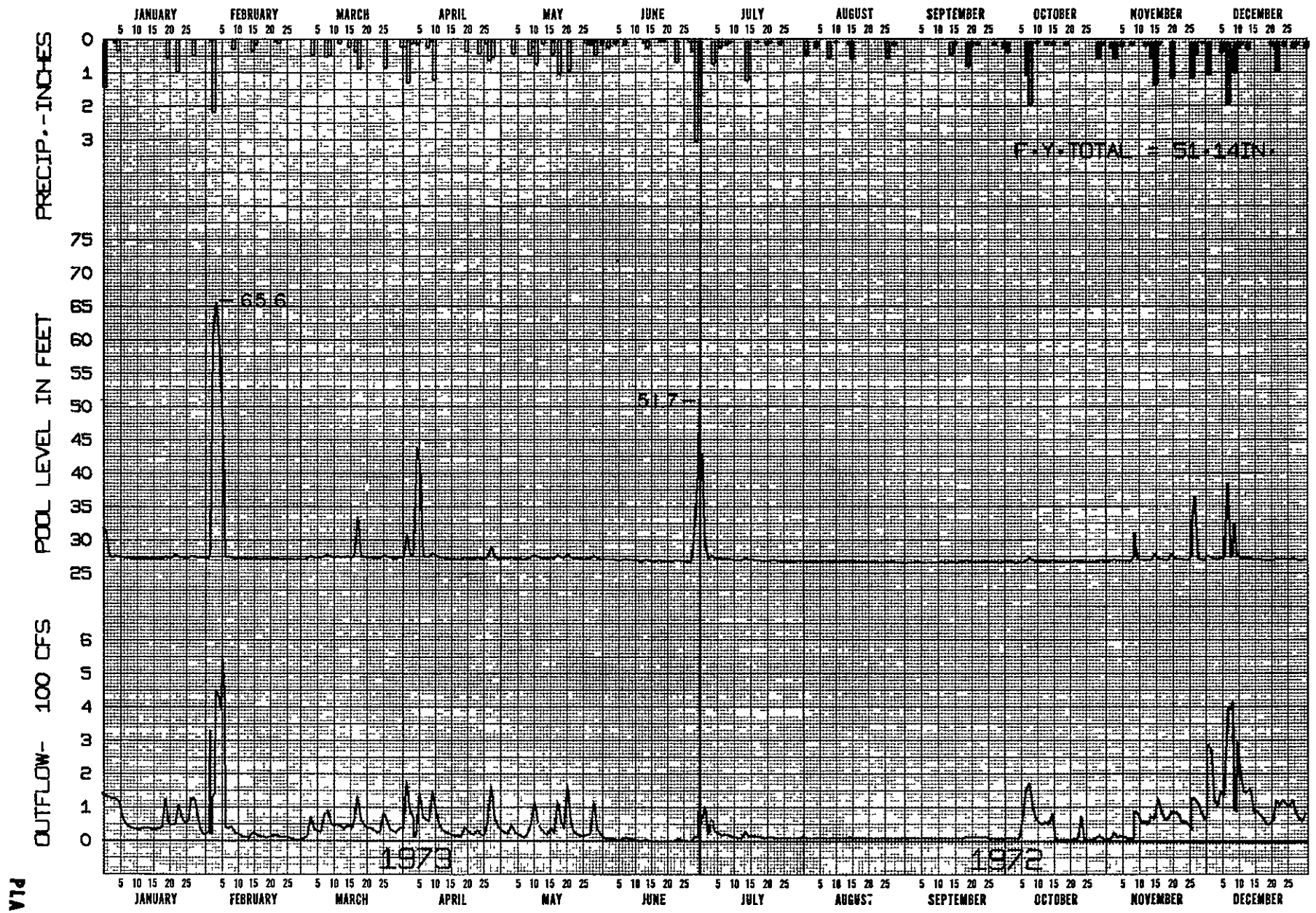


PLATE 31

RESERVOIR OPERATIONS - BLACK ROCK LAKE
F.Y. 1973

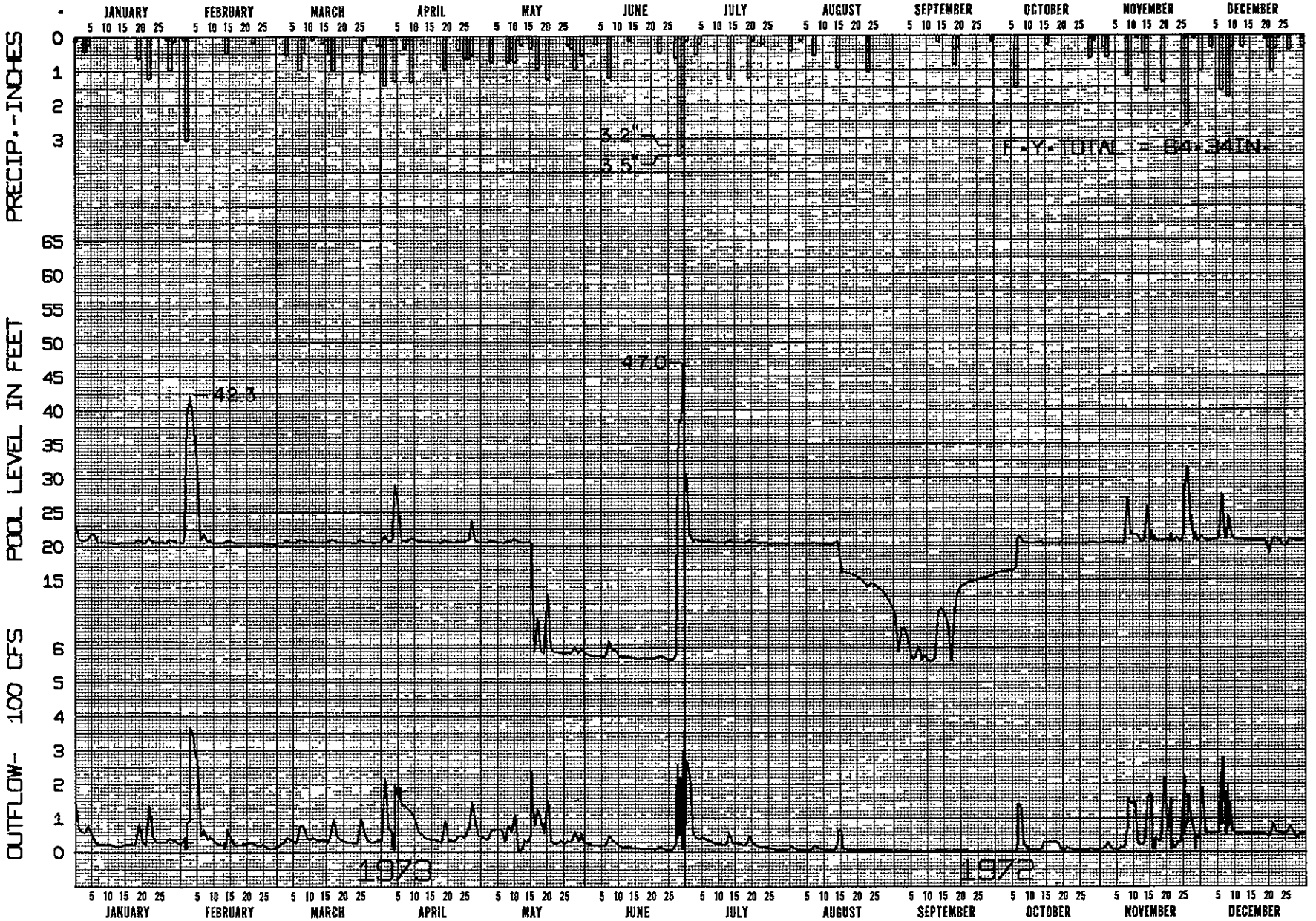


PLATE 32

RESERVOIR OPERATIONS - HOP BROOK LAKE
F.Y. 1973